Hass, Carolin & Bug, Peter. (2018). **The use of apps in food retailing.** Creating value added for customers and companies. Reutlingen: Reutlingen University.

Abstract:
This paper investigates if food retailing mobile applications from Germany, Austria, USA and the United Kingdom are meant to stay a marginal topic in grocery shopping, or if they have the potential to significantly shape the future of grocery retailing by serving as competitive advantages that can fulfil customer requirements and satisfaction. It has filtered out success factors in form of functions of grocery apps and it has extracted key competencies that can be used to create customer value.
The Kano model can help selecting the right app functions. But, there are other prerequisites, like customers' general attitude towards technology and their acceptance towards any kind of apps, that play an important role looking at the big picture of apps in grocery retailing.
However, this paper has contributed one vital part of giving more importance to apps in grocery retailing in form of app functions that clearly deliver customer value.
In short, apps that fit customers' needs and that provide usability and convenience clearly have the potential to shape the future of grocery retailing - if key barriers towards app use are eliminated and if incentives are given that overcome scepticism.

Key search terms: retail, mobile retailing, grocery, food retailing, international mobile app comparison, Kano model

Table of contents

List of tables

List of figures

List of abbreviations

A .....Attractive
App ..... Application
B2C ..... Business to consumer
I .....Indifferent
M .....Must-be
O .....One-dimensional
Q .....Questionable
R ..... Reverse
SMS ..... Short messaging service
SNS ..... Simple notification service

1 Introduction

Today, using the mobile web is shaped by app use (Shopgate, n.d., p. 1). Mainly American companies, like Facebook, Amazon and Google, have early realized that it is not all about acquiring new customers but also about keeping customers - successfully using mobile applications (Gupta, 2013, p. 72). No matter what need or situation in daily life - there is an app for that. Subsequently, popular brands try to join the cause launching their own mobile applications. However, nearly 80 percent of those fail, not being downloaded more than 1,000 times (Mayer, 2012, p. 122).

Nowadays, “Retailers can no longer afford to be laggards in adopting new technologies or in how software applications are implemented. They have to start looking at applications as the game changer for the future by way of creating new services and offerings” (Accenture, 2015, p. 10). Albeit 90 percent of retailers deem smartphones important to their future success (Rosbach, 2013, p. 48), their apps often neither catch customers’ interest nor do they deliver a clear value to users (Mayer, 2012, p. 122).

Also, grocery retailers, in national and international markets, enable customers to load a wide variety of apps onto their smartphones- however, with moderate success. To the present day mobile shopping applications are of minor importance to grocery retailing. Most shoppers have not downloaded their grocer’s app to their mobile devices. “There are very few grocers, if any, who have an app with more than 5 percent shopper adoption” (Karolefski, 2017, p. 98). Of those who do not use a grocer’s app, 71 percent say they did not even think about their existence. 24 percent say they did not consider it worthwhile (Angrisani, 2013, p. 34). There are various key reasons for this. First of all, loyalty toward a specific grocer has never been lower before. Second, customers will not use an app unless they have convincing reasons to do so. Those reasons will have to be more plentiful than those of competitors (Karolefski, 2017, p. 98) and will have to deliver a true value added.

1.1 Presentation of the problem

Grocers, struggling with competitive pressure in tough competitive environments, have to seek ways to differentiate from others. However, most of them do neither have the man power to further investigate the wide area of mobile applications nor

do they have well-elaborated mobile strategies in order to take promising future-oriented decisions when it comes to app use.

In the course of this paper a wide review of literature and industry reports has been done identifying grocery shopping apps as an under researched area due to grocers' lack of interest and strategic direction. There is a lack of understanding about preferred app functions and no consensus about best app approaches. At the best of the authors knowledge, there is literature about grocery apps in general. However, only a few studies have dealt with specific app functions, motivators for app use and how to deliver value added in form of tailor-made app functions. There is also a plethora of studies that deal with shopping apps in general, but they do usually pay little attention to grocery shopping apps. Authors like Karolefski (2017) have put forward grocery apps with unique functions. There are Tukkinen and Lindqvist (2015), who made user-based experiments with a Finnish grocery app, and Karpischek, Geron and Michahelle (2011), who explored the usage of a Swiss third-party grocery app. Childs (2013, 2014, 2015) finished a project of three studies on grocery shopping apps, that build on one another. Those studies partially elicited customer preferences on app use and gave suggestions for future-oriented app functions. Hence, they are of vital importance for the retail segment as retailers must concentrate on possible starting points to enhance the customer value of their applications in order to differentiate from stiff competition. However, the latest two of the most relevant studies have been compiled in 2015. So, results might be outdated. On top of that, there has not been any detailed comparison of grocery apps from different grocery retailers and different countries of origin to filter out best practices. To the best of the author's knowledge, Brune (2015) is the only author who made an attempt comparing German grocery apps according to their various functions. He used a table to illustrate his results. However, the functions explored as well as the sample of retailers seemed incomplete. In conclusion, no piece of literature deals with a systematic analysis of app functions to derive implications for grocery retailing.

Subsequently, the authors found a field of study that is insufficiently treated. Grocery apps from different nations have to be compared referring to their functions in order to provide an overview for all retailers interested in enhancing their apps' adoption rate and in integrating best practice features. Moreover, grocery app use

will have to be explored with respect to motivators and barriers. Taking a customer's point of view is indispensable here as only a product that is rated from a customer's perspective will be able to deliver true customer value. Functions that lead to customer satisfaction are prerequisites to enhance an app's adoption and therefore its importance for the retail segment.

So, this paper is going to investigate if mobile applications are meant to stay a marginal topic in the segment of grocery shopping, or if they have the potential to significantly shape the future of grocery retailing by serving as competitive advantages that can fulfil customer requirements and enhance customer satisfaction. In order to be successful in the mobile market, grocers will have to acquire crucial know-how on app use. Specific competencies in this sector will turn out to be critical factors to outperform stiff competition.

Thus, this paper deals with the following research question:

What are success factors for mobile applications to shape the future of grocery retailing and what key competencies will retailers have to acquire in order to create customer value?

1.2 Systematic procedure and methods

This paper is going to extract factors that can make grocery apps more successful to shape future developments in the food retailing sector. Here, the focus will not be put on key technology, but on app functions that bring value added from a customer's and a company's perspective. The study deals with company apps that have a marketing purpose and that originate from different countries and grocery retailers. B2B apps as well as grocery apps designed by independent developers and third-party companies are deliberately excluded. A customer point of view is of vital importance as well as thorough analysis of existing mobile applications in the food segment to filter out vital success factors. In this context, the authors will provide an overview over the latest trends and relevant technologies shaping today's grocery app market. Based on this knowledge grocers can gain pivotal know-how about successfully optimizing their existing mobile applications and learn how to make customers use them on a regular basis to nurture a flourishing customer relationship.

To build a fundamental basis, the first chapter is dealing with theoretical principles of mobile apps. First of all, the term ‘app’ is to be defined for the context of this paper. A brief digression of app development follows.
In the next subchapter the app is put in the context of mobile marketing. The objectives of mobile marketing apps are to be discussed as companies that launch their own mobile apps should learn what benefits can come with a well-prepared mobile strategy. Apps are used for advertising and for building-up a personalized customer approach. This can stimulate customer loyalty and differentiation.
Then, the subject of the paper is to be further narrowed by providing a definition of grocery apps.
To further examine the topic, extensive literature research is done showing how the subject has been treated so far including current topics. In this context, the app as part of the digital revolution is discussed presenting different viewpoints of researchers and experts. Afterwards, a discussion is presented that stresses the advantages of apps compared to the mobile web.
Then, the paper sheds some light on grocery apps from a customer perspective. This will reveal pivotal approaches of former research and an evaluation of existing app functions. First, motivators and barriers of app usage are extracted from previ-ous studies. Then, customers’ preferred app functions are filtered out before being categorized with the aim to identify app features that can enhance customer value. In chapter five future approaches of grocery app functions are presented to weigh their potential. The focus will be put on research findings about potential future func-tionalities requested by consumers. The second part of chapter five deals with real future approaches of the grocery sector. An overview of innovative app functions is given.
Moreover, questions that need further investigation are entered in the empirical part of the paper. Here, it lends itself to carry out a benchmark analysis regarding competing grocery apps in different markets in order to make a broad comparison and to work out best practice approaches. The detailed app analysis will comprise grocery apps from Germany, Austria, Great Britain, and the US. The practical research will not only reveal different app functions and features, but will also touch cultural differences as well as national market characteristics.

In order to find out which app features have the most positive impingement on customer satisfaction and to verify if preferred app functions identified by past studies are also valid today, the choice of a suitable scientific model is discussed in chapter six. In the end, arguments are put forward that underpin the use of the Kano model. At the best of the author's knowledge, there is no study that has queried grocery app functions using the Kano model before. Key goal of the Kano study will be identifying app functions that bring value added to customers and finding ways to make grocery app use more appealing. On top of that, it provides retailers with a suitable tool to analyze existing mobile applications and to focus on the optimization of app functions that produce value added.

For this purpose, two surveys were conducted: One online to identify suitable app functions, that need further investigation, and one manually in form of a Kano questionnaire. Input from past studies as well as from the preceding online survey was used to create the final questionnaire. It helped to categorize app functions into specific customer requirements.

After having produced a Kano model for grocery apps, the Kano criteria are used creating a scoring model to rate existing grocery apps and guide grocers to optimized future app solutions. Textbook cases of best practice apps will be provided.

In the end, potential future scenarios will be illustrated summarizing the results of the theoretical and the empirical research. This will reveal important factors and must-have competencies for companies successfully attracting customers using apps in the grocery retail segment.

2 Theoretical principles of mobile apps

Before entering the field of mobile applications specifically used in the grocery sector, this chapter is giving an overview of the origin and use of apps in a business context. General information about mobile applications is given with the goal to go into further detail dealing with apps in food retailing in chapter three. However, companies that launch their own mobile applications should keep basics of app development as well as marketing objectives of apps in mind.

Before the use of smartphones became state of the art, the term ‘app’ simply stood for application. Applications belong to computer operating systems and work as direct links between the user and the technology within a computer or similar device. However, the term ‘application’ has been narrowed. Since the launch of Apple’s iPhone in 2007 mobile applications have become integral parts of mobile devices (Kamps, 2015, p. 13). The mobile devices sold today come with a selection of pre-installed applications. Thanks to mobile apps users are enabled to further personalize their smartphones according to their specific needs. In addition to pre-installed apps customers can download a large variety of apps featuring countless functions (Krum, 2012, p. 164).

2.1 Development of apps

App development has grown from a niche market to a booming business (Schönberger, 2014, p. 105). Before companies develop mobile apps, they should carefully consider their mobile strategy, because it will impinge on the positioning of the company’s app in relation to functionality and target achievement. The initiative of building an app can be intrinsic or extrinsic. So, the need of an app may originate from internal analysis or external market evaluation and customer demand (Aichele, 2014, p. 35). When deciding to create an app, companies should never lose sight of their value proposition that helps pursuing a set of strategic goals. In the past, many companies have launched apps without any strategic direction. Subsequently, a lot of apps never achieve a real breakthrough. So, Rowles (2017, pp. 104-105) concludes that apps should deliver some form of utility and entertainment by bolstering a company’s value proposition and strategic direction (Rowles, 2017, pp. 104-105).

2.2 Mobile marketing purpose of apps

This part of the paper will dwell on the outstanding benefits of apps from a company's perspective. As seen in the previous subchapter, apps can have multiple functions in various fields of interest. What those apps have in common, is their role in mobile marketing.

Mobile marketing embraces all marketing strategies addressing potential customers via their mobile phones, smartphones, or other mobile devices (FLYACTS GmbH, 2014, p. 5). In sum, "Mobile Marketing comprises activities of mobile business communication offering digital contents, information or transactions that aim at catching potential consumers' attention in order to generate sales" (Hachen, 2009, p. 146).

According to FLYACTS GmbH (2014, p. 6), the app brings all benefits of mobile marketing together. Users automatically give their permission to receive mobile contents and agree to the terms and conditions by simply downloading an app. On top of that, direct responses of customers are triggered by using the app. Moreover, products and services can be promoted via banners, gamification and sharing of information (FLYACTS GmbH, 2014, p. 6).

The following subchapters give an overview of the objectives mobile applications should pursue in the context of mobile marketing.

2.2.1 Apps as means of mobile advertising

"Mobile advertising is probably the most visible part of mobile marketing" (Okazaki, 2012, p. 104). It originates from the idea that the mobile phone is ubiquitous as users tend to check their smartphones on average 120 times a day (Kamps, 2015, p. 161). So, in this subchapter a suitable definition is derived to explain the role of apps in the field of mobile advertising.

Okazaki (2012, p. 104) states that academic research on mobile advertising is still restrained nowadays. Compared to general research in marketing studies, publications on mobile advertising are sluggish. So, first an attempt is made to give a practical classification of mobile advertising, evaluating different authors' points of view. Mroz (2016, p. 279) regards mobile advertising as a way of successfully promoting an app itself, while according to Okazaki (2012, p. 105 ff.), mobile advertising can have various facets. This opinion is also represented by Rowles (2017, p. 173).

Okazaki (2012, p. 105) sees Barnes' (2002, p. 405) classification as the most practical one. Barnes (2002, p. 405) classified mobile advertising tools into 'push' and 'pull' categories. Pushing means that advertising messages are sent, respectively pushed, to customers, usually in the form of SMS or push-messages. Applying the push method, users of mobile devices are provided with contents without their direct request. Those contents are initiated by the advertiser (Holland, 2009, p. 89). In a pull context, advertising messages are placed within mobile contents (Barnes, 2002, pp. 405 & 408). Barnes sees the essence of successful pull-activities in "targeting to achieve relevance, positive response and acceptance" (Barnes, 2002, p. 408) from consumers. Perception of users is of overriding importance as they must respond to the advertisement in order to receive information or offers. Here, users actively tap or click on banners and advertisements or download an app. This means that potential customers have the explicit option to obtain information or services if requested (Holland, 2009, p. 89). Meyer refers to mobile advertising as a context-pull measure. She argues that the consumers willfully take actions that lead to their contact with mobile advertising in a certain context. Scenarios could be playing a mobile game or browsing the mobile web (Meyer, 2014, p. 76). The following figure summarizes the classification of mobile advertising according to Barnes and Okazaki. Mobile advertising tools are classified into push and pull categories. The response rate provoked by push and pull advertising illustrates the y-axis in the following figure.

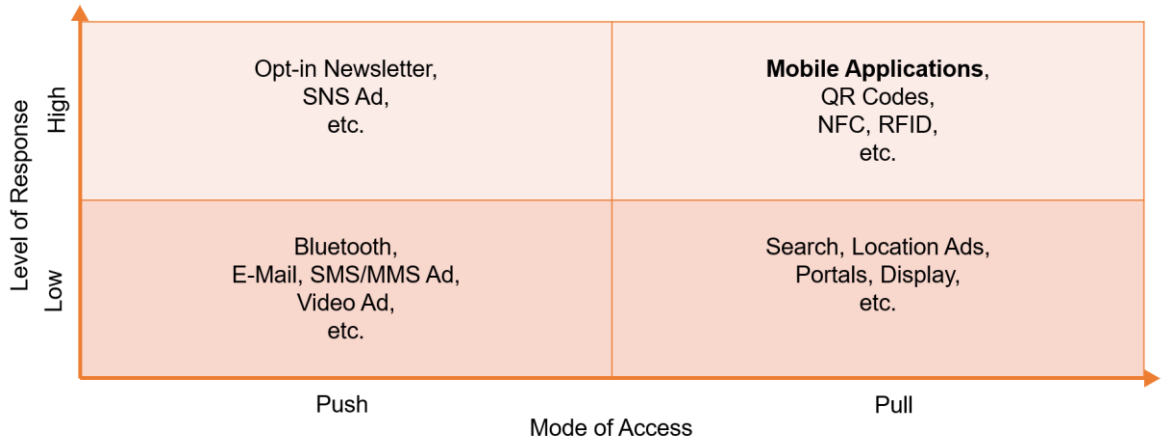

Figure 1: Classification of mobile advertising
Source: Barnes (2002, p. 405) and Okazaki (2012, p. 106)

Within the four quadrants mobile applications are categorized as high response tools in a pull context.

2.2.2 Apps as means of target-oriented customer approach

Nowadays, people usually do not switch off their mobile devices, which leads to continuous reachability. This means that apps can be used all day and night. There are studies proving that even at home people tend to use their smartphones more often than laptops and PCs due to a quicker accessibility (Mroz, 2016, pp. 63-65). This provides companies with the opportunity to show unwavering presence in customers' lives. On top of that, mobile devices are very personal belongings. This helps enter into a direct dialogue with the potential customer and can turn out to be key for differentiation through personalization (Jung, Krüger, Kahl & Löchtefeld, 2013, p. 32). However, a study about digital consumer engagement revealed that only around 19 percent of app contents are tailored to customers' needs and personal interests (Seifert, 2016, par. 3).

2.2.3 Apps as means of customer loyalty

"Apps perform better when customized and simplified, efficiently streamlining shopper use and retailer maintenance. The customization builds brand and deepens shopper engagement. It also leaves the shopper with a sense of control in the relationship they are building with their store" (Childs, 2014, p. 5).

This quote, as one of the key statements in Child's study on 'Enhancing consumer connection with grocery shopping apps', lends itself to illustrate the link between a targeted customer approach and customer loyalty. A customized mobile application helps build a strong brand image and nurtures the relationship between grocer and customer.

If customers see a purpose in installing an app and if companies manage to make them use it on a regular basis, customer loyalty is enhanced (FLYACTS GmbH, 2014, p. 7). The mere existence of a mobile communication channel is seen as a quality feature as it offers an interactive dialogue between customer and company. In this context, a continuous flow of information can strengthen the customer relationship (Meyer, 2014, pp. 52-53). Moreover, apps remain in customers' minds

longer than mobile websites due to their continuous visibility on screen. As people tend to look at their smartphones several times a day, the brand linked to the app becomes a daily visual. Furthermore, if a product is searched in an app, it will be seen closer connected to the brand than if it is searched via search engines and looked at from a mobile website (Shopgate, n.d., p. 9).

In order to give more incentives to enhance customer loyalty, many retailers have introduced their own loyalty applications or have added loyalty features like coupons to their regular apps (Karolefski, 2016, p. 96). Those will be studied in detail in chapter six.

2.2.4 Apps as means of differentiation

According to Childs (2015, p. 16), who analyzed user comments on apps and carried out a customer survey, retailers differentiate from each other through the functionality of their apps. If the app fails to excite the user or if the user finds the usage too difficult, bad reviews are spread via the internet. This is true for a variety of retailers' mobile applications. In contrast, retailers who carefully manage their app and establish functions that are convenient and well-liked by consumers have the opportunity to stand out (Childs, 2015, p. 16). The reputation of an app may be transmitted to the entire company. So, retailers who continuously improve the performance of their mobile app are likely to be seen as future-oriented and innovative compared to competitors (Meyer, 2014, p. 53).

3 Definition of grocery apps in the study context

Chapter two has clearly shown benefits for companies that know how to make use of apps. After having come from apps in general to their key purposes from a company's marketing perspective, the topic is now narrowed to grocery apps.

The term 'app' has already been defined in general. In the context of this study, grocery apps are launched by grocers that operate under a certain brand and pursue a mobile marketing purpose explained in the previous chapter. Hence, grocery apps are mobile applications that are made available in app stores by grocery retailers to provide "digital contents, information, and transactions that aim at catching potential consumers' attention in order to generate sales" (Hachen, 2009, p. 146).

To further define grocery retailers, a look has to be taken on the food retailing sector: Kim and Stiegert (2009, p. 21), who examined structural changes in food retailing, define it as follows:

"Food retailing is defined […] to include supermarkets and grocery stores (including convenience stores) and specialized food retailers" (Stiegert & Kim, 2009, p. 21).

To explore the term 'food retailing' in further detail, North Dakota State University puts forward the following definition:

> *"The retail sector of the food industry encompasses food sold to consumers for preparation and consumption at home as well as the final preparation of food for consumption away from home. Grocery stores and other food markets generally sell food that is not ready for consumption but will require the consumer to complete the final preparation" (North Dakota State University, n. d., par. 2).*

In Stiegert's and Kim's definition supermarkets and grocery stores are two different categories. However, like the definition given by North Dakota State University, the author sees 'grocery store' as generic term that embraces supermarkets as well as other food stores.

So, grocery apps can be developed for supermarkets, convenience stores, specialized food stores and other food retailers. However, this paper puts its focus on apps that are offered by supermarkets, hypermarkets, and discount stores (See Food Retail World, 2004). Other types of food retailers are deliberately excluded. Albeit, there exist a plethora of grocery apps launched by third-party developers. Those

have neither been included in the study. The grocery apps analyzed in this paper exclusively connect end-consumers to food retailers and therefore fulfil a B2C purpose.

A number of app examples that have been subject of this paper is visualized in figure 2.

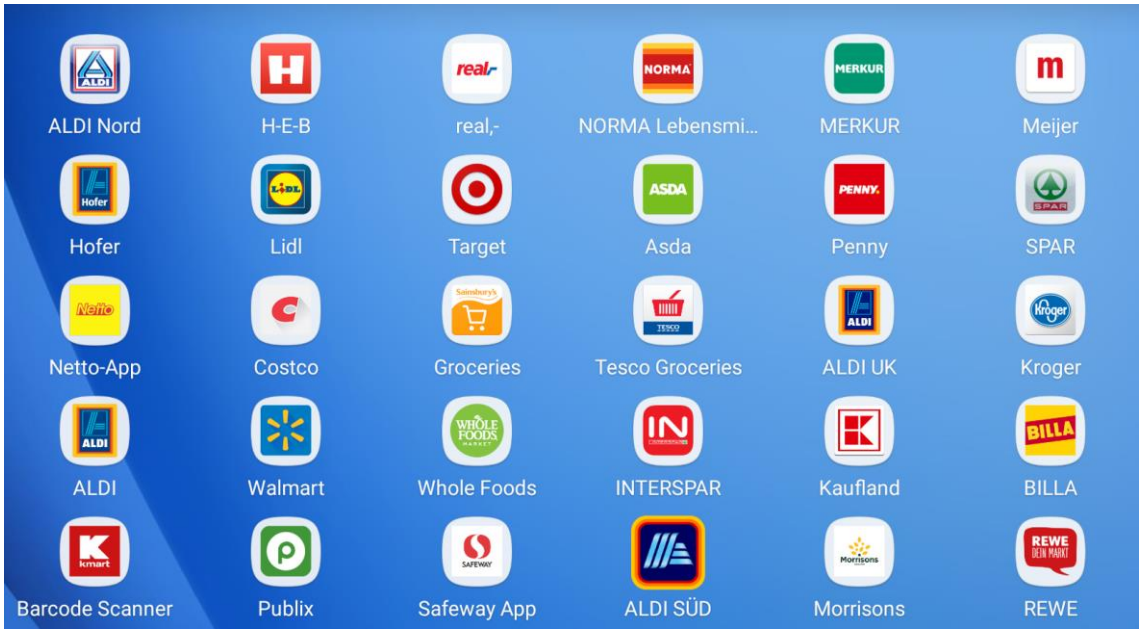

Figure 2: Selection of grocery apps
Source: Screenshot (09/11/2017), edited by authors

4 Grocery apps in current literature

An intensive literature review has been done to illustrate the importance of the subject and relevance of grocery apps in current literature. The goal was to find out which role grocery apps are going to play in the future according to different authors. Two key topics have been filtered out, digital revolution on the one hand, and the competitive struggle between apps and the mobile web on the other. Both subjects will be presented in concert with arguments put forward by authors and experts. Moreover, studies on grocery apps have been found and interpreted that have queried app usage from a customer point of view. They have revealed barriers and motivators for app use as well as customers' preferred app functions. Those will be important to further research to filter out success factors of mobile apps.

4.1 Apps as part of the digital revolution in grocery retailing

When Mihr (2017) cited an expert interview regarding upcoming trends in the food retailing segment for 2017, digitalization turned out to be one of the mostly discussed subjects, even if it is not brand-new. The term 'hybrid shopper' was put forward to describe the modern consumer not only using traditional sales channels but demanding a shopping experience over multiple channels also when buying groceries. Grocers have responded to the increasingly demanding hybrid and digitally native shopper's requirements by digitalizing their stores in order to improve their customers' in-store experiences (Bues, Steiner, Stafflage & Krafft, 2017, p. 157). They have started to sell groceries online and they have launched their own mobile applications (Karolefski, 2017, p. 98). According to Karolefski (2016, p. 96), mobile is about to be "the linchpin of most in-store technology" (Karolefski, 2016, p. 96). He subscribes to the view that grocers should enhance the relevance of in-store experiences by the use of mobile applications. In this context, apps tied to "loyalty programs and customer specific marketing campaigns" (Karolefski, 2016, p. 96) are quoted. The aim should be a cross-channel shopping experience of which mobile is an integral part (cocomore, n.d., p. 3). However, grocers' apps still find it hard to reach a high shopper adoption.

Figure 3 illustrates the number of app downloads in the two mostly frequented app stores. Despite of a rising number of downloads only a minority of grocers reaches a shopper adoption of at least five percent (Karolefski, 2017, p. 98).

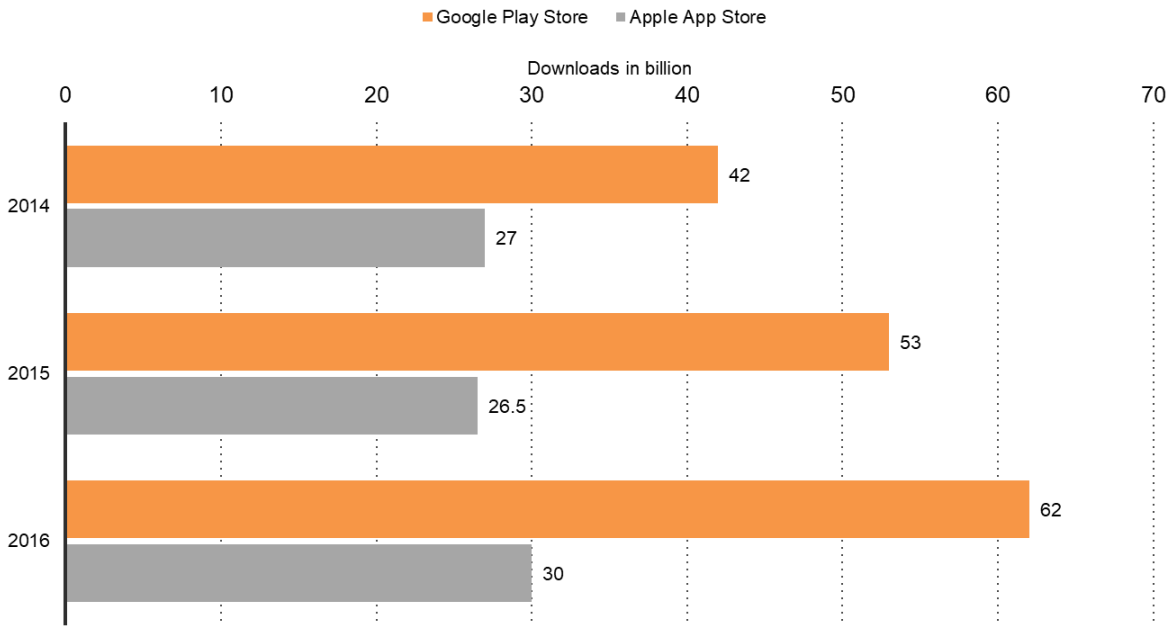

Figure 3: Number of downloads of apps in Google Play Store and Apple App Store in the years 2014 to 2016 (in bn)
Source: Statista estimates and App Annie (2017), translated from German

Today, only a minority of consumers is using their grocer's app (Karolefski, 2017, p. 98), but consumers around the world have a willingness to use certain features of grocery apps in the future. According to Nielsen (2015, p. 16), mobile coupons (18%) and mobile shopping lists (15%) are the most cited features that are already used. About two-thirds of global survey respondents have stated they are willing to use those functions in the future (Nielsen, 2015, p. 16).

Albeit most research has been done with the focus of using mobile applications in-store, there are authors who subscribe to the view that apps are mostly used from home. Karpischek et al. (2011, p. 1) as well as Tukkinen and Lindqvist (2015, p. 41) had each chosen one specific app (one Swiss grocery app and one Finnish) and studied when and from where it was used. Karpischek et al. (2011, p.1) argued that 61 percent of all app requests were done when the mobile device was connected to WiFi. Here, the question arises which WiFi connections were accessed from home and which app requests were done via store WiFi. However, the studies' results show that mobile apps can play an important role in store when shopping (Bues et al., 2017, p. 157), as well as for information seeking at home (Tukkinen & Lindqvist, 2015, p. 41).

Also, Ingram (2016, p. 100) mentions a digital revolution in the grocery sector, but with a focus on personalization. He points out that “mobile will play a major role in this shift” (Ingram, 2016, p. 100) as it comes with the right level of personalization demanded by consumers (Ingram, 2016, p. 100). Subsequently, a wide variety of third-party grocery apps has appeared offering multiple functions in and out of store and grocers have responded in kind (Karolefski, 2017, p. 98). However, Brune (2015, p. 25) argues that apart from a shopping list function, there does not exist a standard on which features should be made available. Despite of the grocers’ efforts and the apps’ vital role in the digital revolution there is no grocers’ app that ranks high in the app stores (Rosbach, 2013, p. 48).

4.2 Potential of apps to beat the mobile web

According to Ingram (2016, p. 100), grocers have already realized that 40 percent of their web traffic have their origin in mobile devices. At the moment, this traffic mostly arises from the grocers’ websites accessed from a mobile browser. However, grocers should put their focus on mobile apps as app use in general is on the rise. When spending mobile minutes, consumers use 82 percent of the time interacting with mobile apps and only 18 percent browsing mobile web sites (Ingram, 2016, p. 100). Also, Gupta (2013, p. 73) claims that apps are to be preferred to the mobile web, when setting up a mobile strategy. Therefore, companies should invest in highly innovative apps. He criticizes banner advertisements and points out that marketers should rather create apps that provide a clear value added for consumers instead of pay for mobile web ads that lack the captive effect on consumers and cannot offer a value proposition (Gupta, 2013, p. 73). Also, Karolefski (2017, p. 98) claims that grocers‘ apps “should be the corner stone of their mobile strategies” (Karolefski, 2017, p. 98). On the other hand, grocers’ engagement in their own app should not be too hasty. Here, app use often seems to be reserved to a selected handful of successful online retailers like Amazon and eBay. However, there have already been multichannel retailers like Target and Walmart who managed to increase the adoption rate of their app due to a mobile strategy and a clear customer value (Fulgoni & Lipsman, 2016, p. 349). This adoption process should be supported by other mobile marketing measures (Karolefski, 2017, pp. 98-99). To Karolefski the most important aspect is that “the grocer needs to focus on educating the consumer

of their app so that the consumer is fully aware of its benefits…" (Karolefski, 2017, p. 99).

In conclusion, "Having an app available when a consumer looks at his or her phone is critical in winning mindshare and generating the mobile traffic that converts into sales, whether online or in store. The prominence with which that app is viewed represents a potentially enormous advantage" (Fulgoni & Lipsman, 2016, p. 349). Hence, as a key competency, grocers should underline the value of their apps which comes across in terms of price, quality, and convenience or all three of them in one application to pull customers away from browsing mobile websites and use tailored applications instead. Grocers who introduce a mobile app offering a clear value added that is successfully communicated still benefit from a first-mover advantage (Karolefski, 2017, p. 99).

Albeit the majority of authors sees more potential in apps than in the grocers' mobile websites, grocers are still reluctant to explore the potential of differentiation. As Childs points out: "Presently, grocery shopping apps offered by retailers seem to be one-size-fits-all and not strategically integrated within the stores' marketing plan" (Childs, 2014, p. 4). Now, the central problem to be solved in this paper is to find out how grocery apps can deliver value added to customers and a competitive ad-vantage to companies. Therefore, research on customers' views and opinions about grocery apps is of vital importance.

4.3 Use of grocery apps from a customer point of view

As mentioned in the introduction of this paper, one of the key problems is the lack of adoption grocery apps have among customers. The authors have reviewed studies and further literature to understand the customer's point of view, when using grocery apps, from a theoretical perspective. First, motivators and barriers for app use are to be analyzed. Second, study results, that have found out consumers' favorite app functions, are presented. The results will lead to further studies.

4.3.1 Motivators and barriers of app use

Important barriers are to be presented before tapping into potential motivators of using grocery apps from a customer point of view. If apps do not offer immediate benefits, they are likely to be quickly abandoned. As potential app users can choose among hundreds of thousands of apps, fees, even when minimal, epitomize an

enormous barrier to downloading an application. When contemplating the download of an app, users tend to browse the comments and ratings that are available in the app stores. Usually apps with reviews under four stars out of five are hardly accepted (Childs, 2013, p. 22). Studies found out that people who do not use a grocer's app never thought about using it or even did not know about its existence (Angrisani, 2013, p. 34). They are unaware of the app due to a lack of promotion. Another key obstacle is the consumer's assumption to be better informed than the store personnel. These problems mainly come up when staff is ill-informed about the handling of mobile coupons or other app features (Childs, 2013, p. 23). Another vital barrier that is put forward by non-app users is their daily shopping routine. Those who buy groceries on a regular basis do not believe that apps can make their shopping more efficient as they are familiar to the shopping process. They have an ingrained routine to organize their shopping lists, collect coupons, and view circulars. Those potential users know where to get which special discount and where to find their preferred products as they are familiar to the store layouts. Hence, they do not consider a grocery app worthwhile (Childs, 2013, pp. 26-27).

A lot of hesitation could also be traced back to the explosive come-up of apps in general. People who made experiences with poorly performing apps, that had not been tested in advance and did not deliver the promising functions and designs, tend to be very skeptical about app use. In summary, many apps have annoyed the user by draining their smartphone's battery life, occupying the memory space, constantly sending push messages, or delivering an abysmal performance (Childs, 2013, p. 27). An increasing number of pop-up ads was also perceived annoying (Childs, 2015, p. 7). Others disliked the user interface due to unreadable displays, tiny information texts, and buttons that were too small for their fingers (Childs, 2013, p. 28). More concerns were voiced about data security and WiFi connectivity in stores (Childs, 2013, p. 27). Sometimes the app performance in store was too slow as WiFi connection was insufficient or not available. Some test persons also feared a loss of privacy due to app use, especially when they had to reveal personal data when subscribing to certain app features (Childs, 2013, p. 28). There is a point when personalization of the application turned out to be too intimate. Digital trust was undermined when users had the feeling of no longer being in control of their personal data. If there is a lack of transparency about what data are collected and for which

purpose, people feel their privacy severely violated. Moreover, consumers voiced concerns about not knowing who else had access to their shopping history. Health insurances, employers or government agencies were named as the recipients of data users were afraid of (Childs, 2015, p. 10).

After having looked at the barriers to grocery app use, motivators from a customer perspective are not to be neglected.

Potential users tend to rather download an app that has a high app store ranking. Linked to this, an app seems more trustful the more subscribers it has (Childs, 2015, p. 7). Childs (2013, p. 23) found out that people would be willing to download a grocery app if they were offered exclusive benefits that were not granted to non-users. Those are preferably savings only given to mobile users in form of coupons and discounts. It seemed reasonable to subscribers to give away personal data in return for exclusive discounts (Childs, 2015, p. 8). Moreover, tracking loyalty points and incentives are considered important functions of grocery apps (Childs, 2013, p. 30). Grocery apps are considered useful when they provide relevant and accurate information.

A Finnish study identified additional three key motivators. First, there is meal planning. People, who see grocery shopping being more than a daily routine and have fun cooking and discovering new products, enjoy using grocery shopping apps. A second group of motivated app users was identified as ‘memory extenders’. Those users are defined as customers who usually have their daily groceries in mind, but might use grocery apps for reminders. Here, the key motivators would be access to information about new products and dishes as well as convenience due to a mobile memory that saves shopping data (Tukkinen & Lindqvist, 2015, p. 41). Furthermore, a target group was identified that uses grocery apps out of fun. This facet of app use is known as the gamification effect (Childs, 2015, p. 9). Relating to that, “Apps have a strong potential to give satisfaction, affirmation, and encouragement” (Childs, 2013, p. 30). App use is seen as emotionalizing. Therefore, grocery apps are also used as self-validation tools. On the one hand, users check if they have made the best bargain and efficiently utilized their given budget. On the other hand, users see apps as confirmation that they can successfully handle technology in daily life (Childs, 2013, p. 27).

Another important aspect is mobile shopping. As some grocery apps already offer the opportunity to shop groceries online, potential customers can see this as one of the most beneficial advantages of grocery apps. Either a lack of time or difficulties to handle grocery shopping make mobile shopping enticing to customers (Tukkinen & Lindqvist, 2015, p. 41).

In conclusion, setting up a mobile relationship with the customer is sensitive as there is only a narrow ridge between the desired interaction and annoyance. Here, the consumer needs to have the control to find a comfort point. It is hard to enter customers' lives as grocery shopping is not done occasionally but on a regular basis, which means that routines have been built up that are difficult to penetrate (Childs, 2013, p. 10) . Barriers like app glitches, unrequested push messages and the fear of giving away personal data remain important according to different studies and have to be eliminated or overcome by key motivators. The motivators and barriers identified in this chapter are summarized in table 1.

Motivators	Barriers
High app store ratings	Low app store ratings
Information	Lack of promotion
Savings	Unawareness of existence
Convenience	Downloading fee
Simplicity	Oversupply
Exclusivity	Waste of time
Personalization	Untrained personnel
Self-validation	Change of daily routine
Fun	Lack of trust
Mobile shopping	Bad experience with apps in general
Meal planning	Loss of privacy
Extended memory	Unpractical user interface

Table 1: Motivators and barriers of using apps from a customer point of view
Source: Compiled by authors

Hence, strategies that embrace key motivators must be developed to successfully promote grocery apps. App training for employees should be offered to provide customers with adequate assistance in store. Exclusive and visible benefits should convince the user. There should be a real advantage in convenience, entertainment, and savings. Operating the app must be easy and nearly flawless.

The main study results above have been elicited in the US (See Childs, 2013 & 2015). Other studies originate from Switzerland (See Karpischek et al.) and Finland

(See Tukkinen & Lindqvist). This fact clearly shows a gap in app research in Germany. In the US, more people are using grocery apps and therefore can clearly articulate their benefits and shortcomings. This epitomizes a key backlog in Germany that should be further explored in the empirical part.

4.3.2 Preferred app functions

Qualitative studies on consumers' preferred app functions have been analyzed. This is of vital importance to retailers in order to extract app functions that deliver customer value. The functions have been categorized according to three key topics: Convenience, Economics, and Personalization. They have been filtered out of four different studies that queried end consumers. All functions below are part of existing apps. Desired app functions that are not embraced by today's grocery apps yet will be discussed in chapter five.

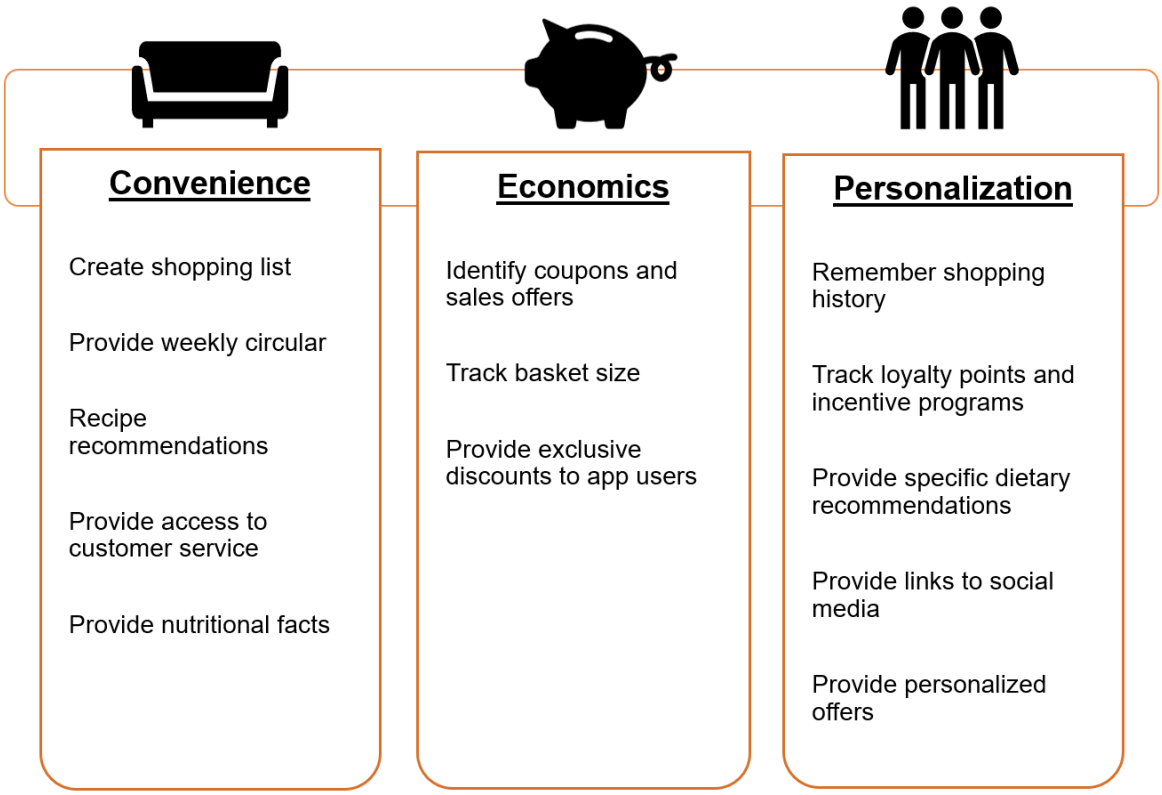

Figure 4: Favourite grocery app functions among users
Source: Acc. to: Childs (2013, p. 25), Childs (2015, p. 16), Mastroberte (2014, pp. 144-147), Tukkinen & Linqvist (2015, pp. 41-43); compiled by authors

5 Future approaches of grocery apps

Chapter four has focused on app use from a customer perspective in order to learn more about their requirements. It has revealed motivators and barriers that should be used to successfully fuel the proliferation of grocery apps, and it has presented key topics that are described in literature. Moreover, preferred app functions from a consumer's point of view have been filtered out. Now, chapter five is giving an overview of consumers' proposals to improve grocery apps. Furthermore, future app approaches of the grocery sector have been explored to find out how apps could shape grocery retailing in the future.

5.1 Future approaches from a customer perspective

Childs (2014), Tukkinen and Lindqvist (2015) have queried app functions users currently miss and that would be enjoyable and useful in the future. The proposals from a customer point of view are described in the following.

First, literature has stated that consumers like building a mobile shopping list with their grocer's app. To make this feature more convenient, the offer of prefilled templates was suggested. Customers could get a prefilled shopping list, derived from their personal shopping data. A more sophisticated solution would be prefilled shopping lists according to certain persons' or families' diets (Tukkinen & Lindqvist, 2015, p. 41). Also, American users wanted their shopping list to be ready before they shop. This suggestion goes hand in glove with the wish of getting dietary recommendations from the app. If a certain product did not fit a specific diet, or food intolerance, they would expect their app to recommend substitute products (Childs, 2014, p. 27). Another vital suggestion was in-store localizability. In order to save time consumers would like their app to locate specific products in store and show them the shortest route for their grocery shopping (Childs, 2014, p. 27). As third-party apps already offer price comparisons on the basis of circulars, consumers would expect this function also being part of their grocer's app. Moreover, a scan and check-out feature via smartphone would be highly valued by customers in order to save time. Personalization was mentioned in the context of a personal event reminder within the app. Here, consumers would be willing to reveal personal data in order to get birthday and anniversary reminders linked to recipes and party products (Childs, 2013, p. 24).

The following figure summarizes consumers' proposals derived from previous studies. Customers' wishes can highly impinge on their satisfaction.

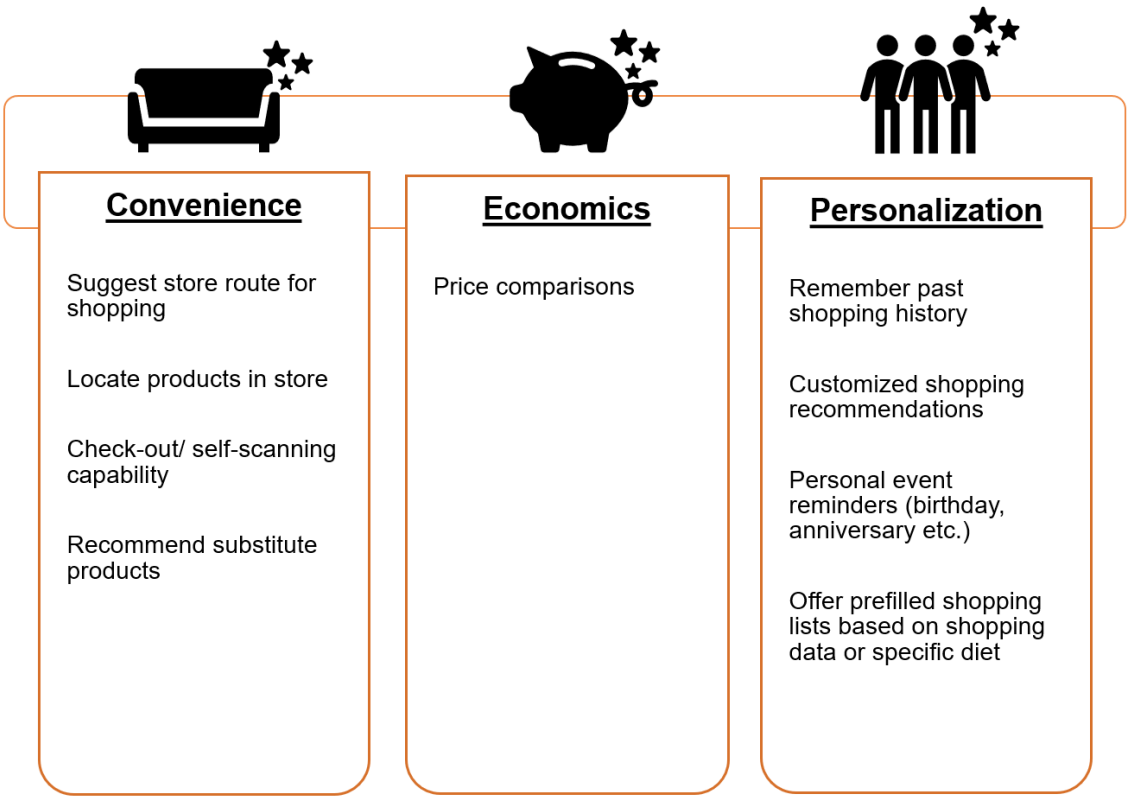

Figure 5: Future grocery app functions extracted from several studies
Source: Childs (2013, p. 25), Tukkinen & Lindqvist (2015, p. 41)

5.2 Future approaches from the grocery sector

Now, after having presented future app functions suggested by consumers, the thesis will shed some light on future app approaches that are under way in the grocery sector. Here, the authors also refer to input from third party app developers in order to provide an overview over app innovations in food retailing. Functions will be di-vided into in-store and out-of-store usage.

When it comes to in-store usage, the ShopWell app by HarvestMark, a third-party developer, engages customers who are on restricted diets. Scanning the bar code of a product will reveal its ingredients, check if it is suitable for a certain diet, like gluten free or vegan, and will suggest substitute products for intolerances. The app benefits from healthy living trends and movements. It integrates weight management, heart-healthy and diabetes parameters (Mastroberte, 2014, p. 144). A similar

approach is pursued helping customers finding groceries from sustainable sources (Noblitt, 2015, p. 35). Moreover, the use of beacons is further explored and tested. Within 60 meters the small Bluetooth senders can access Android and Apple devices in store (cocomore, n.d., pp. 4-5). Some American food retailers, like Golden Pantry Food Stores, have further engaged in this technology in order to send personalized coupons and share instant data. Customers have to download the app and give their permission to receive Bluetooth messages in store (Karolefski, 2016, p. 97). The Swiss supermarket chain Migros has managed to link its app to the Apple Watch. Other wearables are to follow. Customers can now browse their mobile shopping list via smartwatch instead of taking out their smartphones when buying groceries. The list can be shared and edited by more than one user (Loderhose, 2015, p. 41). Moreover, the French hypermarket chain Auchan tries to add in-store navigation to their app 'My Auchan'. As suggested in chapter five, the app shall navigate the customer through the large store according to a fixed shopping list (Flier, 2013, p. 1). In the US, California Fresh Market is testing the self-checkout feature. Customers scan their items with their smartphones. The check-out is done via QR code and the bought groceries are paid by mobile payment or credit card (Webber, 2017, p. 20). In this context, Rode (2017b, p. 37) referred to Lidl as technology pioneer of the German retail sector. The grocer is testing a self-scanning app function in Portugal. Lidl Shop&Go is the mobile application that enables customers to self-scan products with their smartphones before check-out. Afterwards, payment is done in cash or by card. Also Waitrose has trialed a self-scan app for shoppers (Hobbs, 2016, p. 1). The Swiss Coop and Albert Heijn already offer mobile solutions. Penny Italy and Globus in the Czech Republic are also planning to launch first self-scanning projects (Rode, 2017b, p. 37). On top of that, Lidl is installing so-called imagers in selected stores. These devices can read codes on smartphone screens. They serve as prerequisites if Lidl wants to introduce mobile coupons or their own loyalty card in the future (Rode, 2017b, p. 37).

After having looked at app functions that are meant to be used in store, there are other future app features to be presented. Here, customers do not need to use the app inside a grocery store.

Roamler, a Dutch start-up, has added a function to their app that makes the customer complete surveys about competing grocery retailers. They let customers

check competitors' products, advertising materials and store availability (Holst, 2013, p. 1).

Migros, the Swiss supermarket chain, has built up a community around its products to gain valuable product ratings from customers (Busche, 2017b, p. 41). Albert Heijn combines product information with an augmented reality experience. Customers receive recipes and information on ingredients by scanning the products' packages (Busche, 2017a, p. 38).

Auchan has developed a programmable alarm within its app that is activated when products are close to their minimum durability date. To activate this function customers have to scan a code on the product before they store it at home (Flier, 2013, p. 1).

In order to bring small grocery stores and bakeries online, App&Eat has been developed. The aim of this mobile application is to enhance take-away shoppers' convenience. Customers order their lunch via app, pay it in advance and fetch it without queuing. When buying rolls for lunch break, different toppings can be selected and the meal is prepared freshly before taken away. The concept is tested in Düsseldorf to also serve convenience stores in the future (Ohs, 2017, p. 38).

Lidl has developed an app function that shows the availability of products in stores. When a customer wants to buy a certain product in his or her closest Lidl store, availability can be checked from home. This enhances convenience, especially when shopping limited promotion articles. The app also gives a comprehensible availability forecasting. The prototype is to be launched in Austria (Rode, 2017a, p. 37).

Potential future app functions are compiled in table 2.

In-store	Out-of-store
Shared shopping list	Availability check
Free-from and dietary information	Customer platform
Track product sustainability	Health functions
Self-checkout	Link to food trends and diets
Self-scanning	Durability warning
In-store navigation	Personalization of food
Compatibility with wearables	Augmented reality
Push messages via beacons	Competition monitoring

Table 2: Summary of potential future app functions
Source: Compiled by authors

6 Benchmark analysis of grocery apps

After grocery applications have been explored on a theoretical basis, selected apps of grocers are to be presented and tested to compile an overview of optimized app functions. In this context, it has to be stressed that the tests will not focus on IT-based criteria, like the danger of an app crash or the impingement on the smartphone's battery, but will look at selected app functions from a retailing perspective with focus on customer preferences. As a suitable method, the benchmark analysis has been chosen. Benchmarking is defined as continuous comparison of products, services or processes in different companies to work out differences and improvement opportunities in order to systematically close the gap between the best player's performance and the challenger (Wübbenhorst, n. d., par. 1). In the context of this paper, an industry-specific benchmarking has been carried out to compare competing grocery apps with regard to their specific functions. The selected apps have been downloaded to an Android tablet as well as an Android smartphone. An-droid devices have been used due to the fact that foreign applications are not avai-lable in German app stores, but can be downloaded in form of apk files on android devices.

Selected grocery apps from supermarkets, hypermarkets and discount stores will be presented in detail after a short overview of their national app market. This study will deal with apps from Germany, the US, the UK, and Austria. Different app functions will be collected and assigned to the relevant apps. The analysis will show differences in functions and differences that emanate from cultural peculiarities. The following illustration shows a section of the initial research design. The analysis has been done from the 23rd of October to the 23rd of November in 2017.

Function/Grocer	Edeka	Netto	Lidl	Kaufland	Rewe	Penny	Aldi Süd
Alarm Clock					x		x
Curated Offers	x	x					
Customer Service	x		x				x
Dietary Recommendations	x						
Feedback			x	x			x
Loyalty Program		x			x		
Mobile Circular	x	x	x	x			
Mobile Coupons	x	x				x	
Mobile Payment	x	x					
Mobile Receipt		x					
Newsfeed	x	x					x
Newsletter			x				x
Online Shop			x		x	x	
Personal Account	x	x	x	x	x		
Product Ratings			x				
Product Recommendation							
QR Code Scanner		x					x
Recipes	x	x		x	x		x
Search Function			x				
Shopping List	x	x	x	x	x	x	x
Social Media			x				x
Special Offer List	x	x	x	x	x	x	x
Store Finder	x	x	x	x	x	x	x
Track Basket Size			x		x	x	
Video contents	x						x

Table 3: Extract of app function analysis for Germany
Source: Compiled by authors

The app functions in table 3 have been detected and tested as part of the benchmarking process. The initial test functions have been extended during the analysis. .

6.1 German grocery apps

At first, German grocery apps are presented. 78 percent of Germans have a smartphone (Heise online, 2017, par. 1). Of those almost 30 percent have installed eleven to 20 apps (ForwardAdGroup, 2017). On average a German smartphone owner spends 1.5 hours per day using mobile applications (Kasper, 2017, par. 1). 28 percent of German customers aged over 27 have their shopping list on their smartphones (Brune, 2015, p. 26).

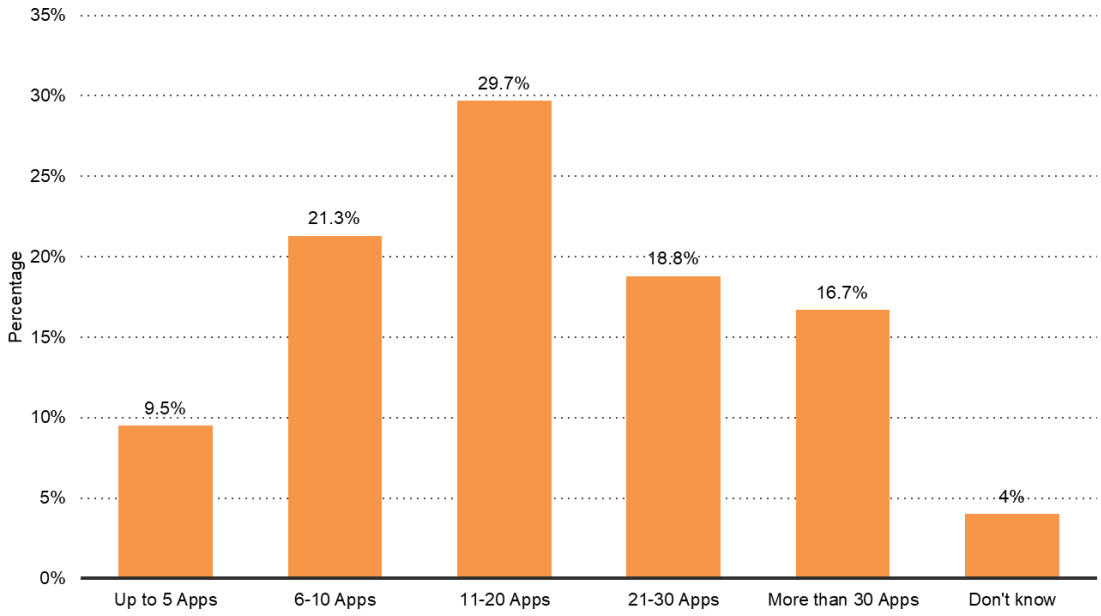

Figure 6: Number of apps installed on German smartphones
Source: ForwardAdGroup (2017), translated from German

The analyzed apps shown in table 4 belong to Germany's top 30 of food retailers (LZ Retailytics, 2017). Norma was added, albeit it is rated number 14.

1.	**Edeka**
	Netto
2.	**Schwarzgruppe**
	Lidl
	Kaufland
3.	**Rewe Group**
	REWE
	Penny
4.	**Aldi**
	ALDI SÜD
	ALDI Nord
5.	**Metro Group**
	Real
14.	**Norma**

Table 4: Germany's Top 30 grocery retailers
Source: Acc. to: LZ Retailytics (2017), sorted by parent company

There are two app functions that the ten grocery apps have in common. First, a list of special offers and second, a store finder. Nine out of ten apps offer a shopping list. However, the lists are of different quality. With the Edeka and REWE app customers can add the ingredients of recipes they select in the app. Kaufland and Netto

make it feasible to build a shopping list by scanning products consumers already have at home. With Kaufland, REWE, Penny, ALDI SÜD and ALDI Nord the shopping list can be shared via e-mail, SMS or Whatsapp message.

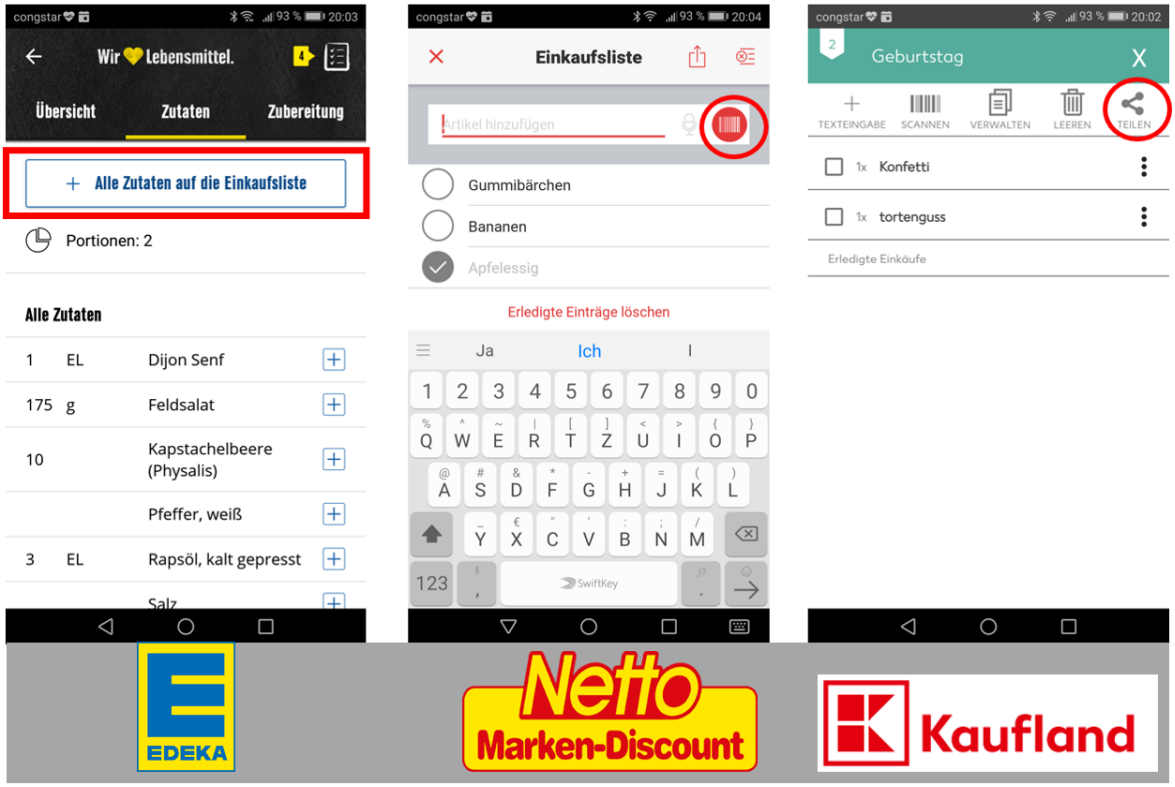

Figure 7: Different shopping list features of Edeka, Netto and Kaufland
Source: Screenshots (05/11/2017), edited by authors; Kaufland Warenhandel GmbH & Co KG (n.d.), Logos Download (n.d.), Netto Markendiscount AG & Co KG (n.d.)

Five apps embrace a recipe section. Here, Netto stands out as recipes can be adapted to the number of people, while customers have the opportunity to rate them. ALDI SÜD differentiates itself thanks to a menu configuration tool. Users are enabled to arrange an entire menu with starter, main course and dessert. Prices and ingredients are displayed in real time. On top of that, Edeka offers curated recipe alternatives according to the customer data entered in a personal profile. Here, the customer can select his or her specific diet like vegetarian, gluten-free or vegan.

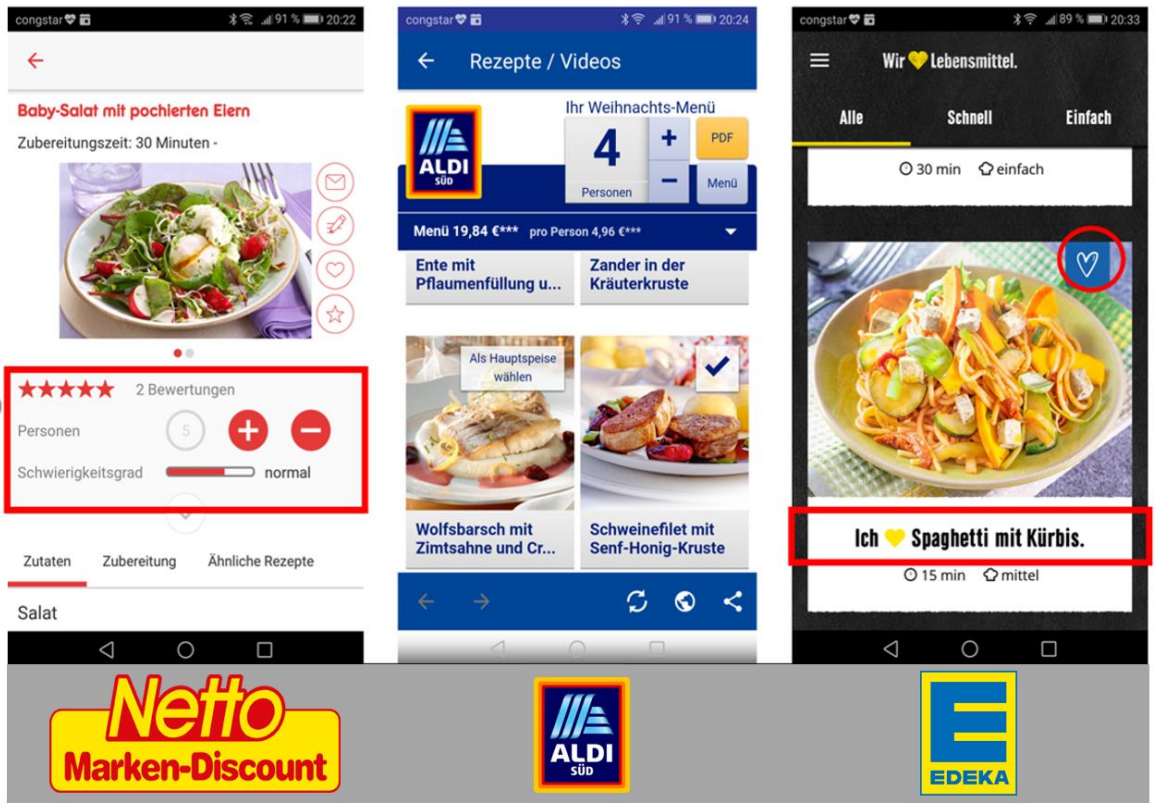

Figure 8: Different recipe features of Netto, ALDI SÜD and Edeka
Source: Screenshots (05/11/2017), edited by authors; ALDI SÜD (2018), Logos Download (n.d.), Netto Markendiscount AG & Co KG (n.d.)

Mobile coupons are only included in the Edeka, Penny and Netto app. The Edeka and Netto coupons do not consist of a bar code but are to be captured manually at the cashier. Customers of Netto who open a personal account via the app are promised an automatic processing of the relevant coupons when using mobile payment. Five grocers grant access to their online shop within the app. While Norma and Penny mostly sell promotional products online, Lidl offers a larger selection of durable food products. REWE delivers fresh food that has been ordered mobile to a restricted number of urban areas, while Real has limited its online food range to alcohol. Lidl and REWE are the only German grocers who enable mobile shopping via the app, while the other apps are connected with the mobile websites.

6.2 Austrian grocery apps

92 percent of Austrians have a smartphone. Of those, 86 to 93 percent, depending on the region, use the mobile web. 37 percent use their smartphones in-store. They compare prices (26%), look for special offers valid in a specific store (22%), check

information on products and services (20%), or build their mobile shopping list (20%) (Sammer, 2016). According to Stenger (2017, p. 86), from 2016 to 2017 the number of people who use a mobile shopping list in Austria has risen to almost every second person. 37 percent use their smartphones to benefit from discount promotions. Households with children use their smartphones more often for grocery shopping (48%) than households without children (32%) (Stenger, 2017, p. 86). 94 percent of the mobile web users have downloaded apps on their smartphones. 29 percent of those indicated that they have been using three to five apps within the last 30 days. In conclusion, they seem to use a limited number of apps intensely. 40 percent have up to ten apps installed to their smartphones. 25 percent have personalized their smartphone with eleven to 20 apps. Applications that have access to the user's location are used by 73 percent. 45 percent of Austrian app users allow push messages (Sammer, 2016). Austrians also seem open-minded towards beacons. In a survey that queried acceptance of beacon technology every second Austrian stated they would use beacon technology once available in-store. Apps of Billa, Merkur and Hofer are used by nine to eleven percent, which, according to literature, can be seen as a high adoption rate (Karolefski, 2017, p. 98). Apps of Interspar and Lidl make up for 6 percent of user adoption; Spar five percent. Four percent of app users stated they use the Hofer and Merkur app on a regular basis (Stenger, 2017, pp. 87-88).

The following apps have been ranked according to revenue before being analyzed:

1.	**Spar**
2.	**Hofer**
3.	**Billa**
4.	**Merkur**
5.	**Interspar**
6.	**Lidl**
7.	**Penny**
8.	**Mpreis**
9.	**Adeg**
10.	**Unimarkt**

Table 5: Leading grocery retailers in Austria
Source: Acc. to: RegioData Research (2017)

It came clear that Penny and Lidl released different apps in Austria than in Germany. The Austrian apps could not be accessed as an apk version is not available on the

internet. The Spar app has not been available. When downloading the app, the user is being forwarded to the grocer's mobile website. Adeg does not offer an app. In the end, the apps of Billa, Merkur, Interspar, Unimarkt, MPreis and Hofer could be compared. It came across that the apps set a different focus. The Merkur app offers a plethora of functions when scrolling down, while Billa focuses on a very limited number of features on a fixed screen. The functions as well as the design of the MPreis app are very minimalistic.

Figure 9: Homescreen of Billa, Merkur and MPreis
Source: Screenshots (05/11/2017; 23/11/2017); BILLA AG (2018), Merkur Warenhandels AG (2018), MPreis Warenvertriebs GmbH (2018)

Billa and Merkur place great value on their loyalty programs, 'Billa Vorteilsclub' and 'Friends of Merkur'. Mobile coupons and mobile receipts can only be accessed after applying for club membership. While Interspar and Hofer offer standard functions, Merkur, for instance, is the only Austrian app that integrates a blog where customers can share opinions about products and communicate. Moreover, Merkur has introduced 'Marktforscher', a game for kids. The main game consists of a paper chase in Merkur stores. Billa, Unimarkt and Merkur enable smartphones to receive push messages via beacons in store. Billa, Merkur, Unimarkt and Interspar have linked their online shop to their mobile apps.

Unimarkt has highly innovative app functions. Shopping is enabled within the app without a link to the mobile website. Products can be added to the basket via drag and drop and shopping lists can be shared. The additional product information is very detailed, while the purchase history is an integral part of the app to simplify the shopping process.

6.3 English grocery apps

In the United Kingdom there are 46.4 million smartphone users in 2017. This number is expected to rise to 54 million in 2022 (Statista DMO, 2017). The development of smartphone ownership by age is illustrated in figure 10.

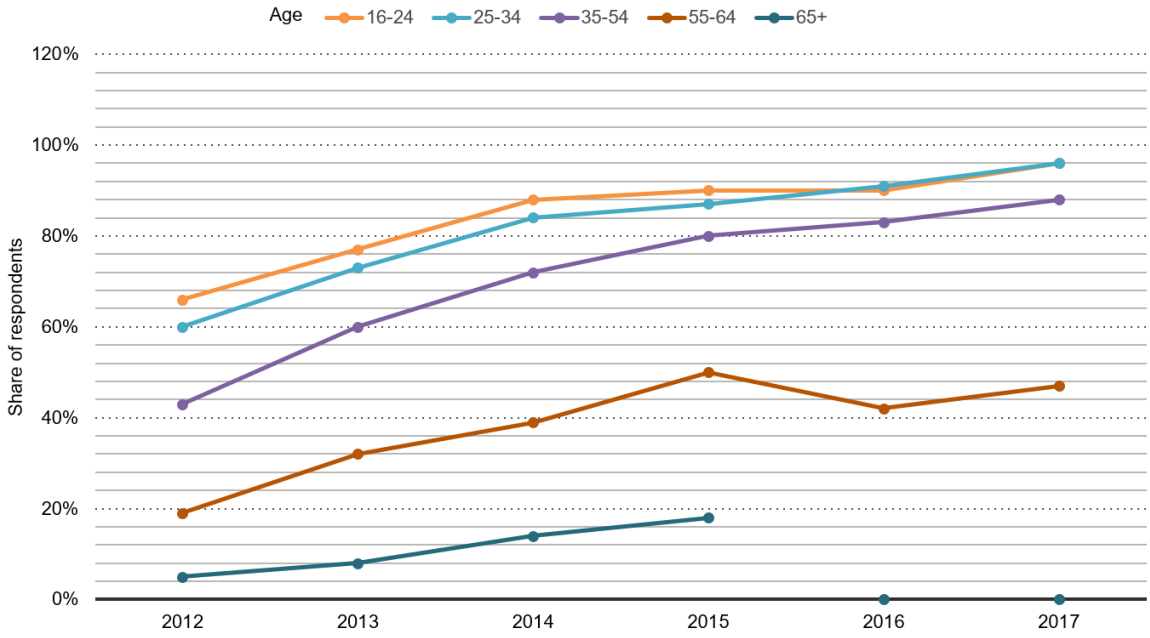

Figure 10: Smartphone ownership by age in the UK
Source: Ofcom (2017)

As smartphone and tablet use has become ubiquitous in the UK, app usage has seen a massive increase. For smartphone users in the UK in-app time amounts for one hour and 55 minutes per day (eMarketer, 2016, par. 5).

The grocery apps in table 6 have been included in the analysis. All of them belong to the UK's top retailers (RetailEconomics, n. d.). While the Co-operative does only offer a magazine app, an app of the British grocer Iceland is not existing. On top of that, the app of Waitrose could not be accessed as it is not available in a suitable apk version.

1.	**Tesco**
2.	**Sainsbury's**
3.	**ASDA**
4.	**Morrisons**
5.	**ALDI**
6.	**The Co-operative**
7.	**Marks&Spencer**
8.	**Waitrose**
9.	**Lidl**
10.	**Iceland**

Table 6: Extract of top 10 UK retailers
Source: Acc. to: RetailEconomics (n. d.)

Compared to Austrian and German grocery apps, those from the United Kingdom have set a different focus. Instead of standard app functions English grocery apps have been developed to become mere mobile shopping apps. Lidl UK is the only grocer that has not set up a mobile shop yet. Tesco, Sainsbury's, ASDA and Morrisons sell their wide range of groceries via smartphone. Marks & Spencer has integrated a food online shop into an arrangement of clothing, household, and general merchandise. The ALDI UK app enables users to shop wine and specials. Figure 11 shows the focus on functional design. With a focus on mobile shopping, standard app functions, like building a shopping list, have disappeared from every second analyzed English grocery app. In conclusion, in-store app usage does no longer seem a vital part of grocers' mobile strategy in the UK. The shopping list functions of Tesco, ASDA, Morrisons and Lidl have remained. Also, ALDI UK does not offer this functional feature that is standardized in other ALDI apps. While the Lidl shopping list can only be filled manually, ASDA customers can transfer recipe ingredients to their list.

Mobile coupons are offered by none of the apps and loyalty programs are only linked to the Tesco and Marks & Spencer app. Tesco and Sainsbury's stand out providing customers with the nutritional facts of all listed products; ASDA, Morrisons, Marks & Spencer and ALDI UK of some. Tesco also gives allergy and intolerance information while suggesting a range of recipes dedicated to healthy living and diet trends.

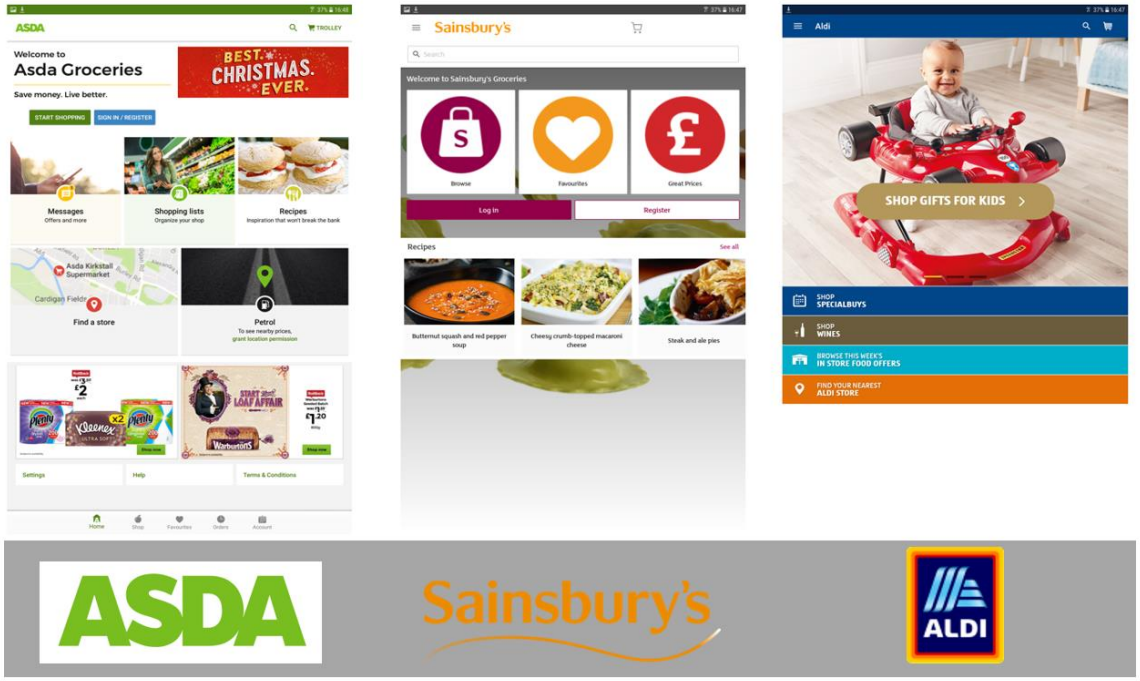

Figure 11: Functional design focused on mobile shopping illustrated by ASDA, Sainsbury's and ALDI UK
Source: Screenshots (05/11/2017); Aldi Stores Limited (2018) ASDA (2017), J Sainsbury plc (2018)

6.4 American grocery apps

In the US the number of smartphone owners has increased from 35 percent in 2011 to 77 percent in 2017 (Pew Research Center, 2017, par. 2). While in 2015 Americans spent 198 minutes using mobile apps (futurezone, 2015, par. 2), in 2017 app usage accounted for 220 minutes (futurezone, 2015, par. 3). Americans use approximately ten to eleven apps per day (Perez, 2017).

The following grocery apps have been analyzed:

1.	**Walmart**
2.	**Costco**
3.	**Kroger**
4.	**Target**
5.	**Safeway**
6.	**Publix**
7.	**Sears**
	KMart
8.	**H.E.B.**
9.	**Costco**
10.	**Whole Foods Market**

Table 7: Ten largest grocery chains by revenue in the US
Source: Acc. to Shah (2017)

ALDI US has been included in the analysis to gain results from a direct comparison of the different apps of the originally German grocer.
While the apps of Walmart, Costco, and Kroger look very similar, Safeway and Publix offer limited functionalities.
A shopping list can be built with every American app. The Walmart shopping list cannot only be shared, but can also be searched and opened by shoppers whose personal accounts are linked to each other. Every app includes a special offer list and a store finder. The store locator is often directly connected to a shopper's account to receive tailored offers that fit the closest store. Loyalty programs are vital parts of American grocery apps. So, personal shopping accounts can be matched with grocers' loyalty cards or third-party cards. Registrations have been unproblematic apart from the Publix app, that only grants access if the user is directly located in the US. Aldi US and H.E.B. do not require personal subscription. Six of the selected apps have added nutritional facts. Also, six grocery apps provide direct access to the grocers' online shop. Costco promotes same day delivery via the app.

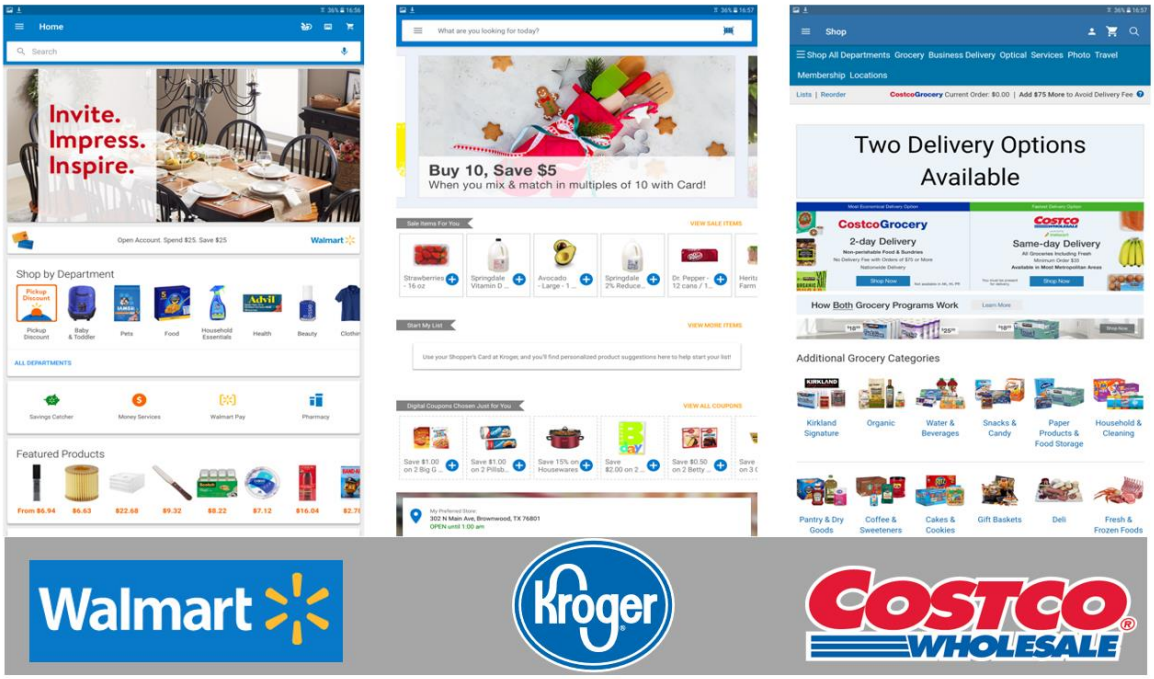

Figure 12: Similarity of Walmart, Kroger and Costco
Source: Screenshots (05/11/2017); Costco Wholesale Corporation (2018), The Kroger Co. (2018), Wal-Mart Stores (n.d.)

In addition, five innovative app functions have been extracted. Four of them are part of the Walmart app. First, there is the availability check. When shopping at Walmart online, a system refers to real-time data that lets the customer know if a certain product is in stock. Similar functions provide information in the Costco, Target and the KMart app. Second, the purchase history is closely interlinked with Walmart's latest innovative feature, the reordering function. The system creates a list of bought items according to frequency. It integrates in-store and online purchases and therefore enables a simple reorder. Moreover, films or DVDs bought at Walmart can be watched on mobile devices via the app. On top of that, the app enables customers to make price checks in store by scanning EAN codes.

ALDI US and Kroger provide value to customers by letting them check their gift card balances via the app.

6.5 Analysis of selected app functions

Having looked at grocery apps from different nations, it comes clear that there is no one-size-fits-all solution for a perfect grocery app as indicated in literature (Childs, 2014, p. 4). Grocery apps come with a lot of variety. The app functions that have

been extracted during the author's analysis will be summarized and selected app functions will be discussed in more detail.

In sum, 34 apps could be tested, which led to the discovery and analysis of 35 app functions. Table 8 gives a summary illustrating how many apps are equipped with a certain function. The app functions that match customer preferences identified in chapter four have been marked in orange. Of those, the special offer list is adopted by most of the analyzed apps (91%), followed by the shopping list function (82%). A mobile circular is provided by more than half of the apps (53%). The same number of apps enables the tracking of customers' spending.

50 percent of the apps provide an overview over their current product range.

Customer service can be contacted by 47 percent of the apps. Nutritional facts are provided by 47 percent as well. While the store's loyalty program is connected to 44 percent, recipes are adopted by more than one third (38%). 35 percent offer mobile coupons. A connection to social media (29%), a shopping history (26%) and curated, respectively personalized, offers (9%), build up the rear.

At this point, the number of grocery apps that have integrated mobile shopping or that at least are linked to the grocer's online shop in form of a mobile website should be highlighted. 62 percent enable mobile shopping. While some are in the teething period, selling promotional products or durable foods, others spearhead selling fresh groceries via the internet. Table 8 illustrates the backlog of Germany in this sector. Only 50 percent of German grocery apps are linked to an online shop.

In conclusion, there is a limited number of preferred app functions, that is adopted by a majority of the tested apps.

Main reasons for the lack of adoption of allegedly most preferred app functions could be technical hurdles or insufficient knowledge of customers' preferences. However, customers' preferred requirements, extracted from previous studies, could be outdated. That is the key reason why a new study about app functions, that enhance customer satisfaction and fulfil customer requirements, is of vital importance. Finding new scientific evidence for demanded app functions will be key topic of the following chapter.

Function/Country	Germany	Austria	UK	US	Sum
Apps tested	100%	100%	100%	100%	100%
Special Offer List	100%	67%	86%	100%	**91%**
Store Finder	100%	83%	71%	100%	**91%**
Shopping List	90%	67%	57%	100%	**82%**
Personal Account	70%	67%	71%	82%	**74%**
Online Shop	50%	67%	86%	55%	**62%**
Newsfeed	50%	67%	57%	64%	**59%**
Search Function	20%	33%	100%	82%	**59%**
Mobile Circular	70%	50%	14%	64%	**53%**
Track Size of Basket	40%	67%	71%	45%	**53%**
Information on Origin	80%	17%	86%	18%	**50%**
Overview Product Range	10%	50%	71%	73%	**50%**
Customer Service	40%	50%	43%	55%	**47%**
Feedback	30%	50%	57%	55%	**47%**
Nutritional Facts	10%	50%	86%	55%	**47%**
Loyalty Program	30%	50%	29%	64%	**44%**
QR Code Scanner	40%	50%	0%	64%	**41%**
Recipes	50%	33%	29%	36%	**38%**
Mobile Coupons	30%	50%	0%	55%	**35%**
Product Ratings	10%	0%	57%	55%	**32%**
Quality Labels	80%	17%	14%	0%	**29%**
Social Media	20%	33%	29%	36%	**29%**
Purchase History	0%	50%	71%	9%	**26%**
Notification for Specials	40%	17%	14%	18%	**24%**
Newsletter	40%	17%	0%	18%	**21%**
Product Recommendation	10%	17%	14%	36%	**21%**
Availability Check	0%	0%	0%	36%	**12%**
Mobile Payment	20%	17%	0%	9%	**12%**
Mobile Receipt	20%	17%	0%	9%	**12%**
Accessibility to Beacons	0%	50%	0%	0%	**9%**
Curated Offers	10%	0%	14%	9%	**9%**
Video Contents	20%	17%	0%	0%	**9%**
Gift Card Balance	0%	0%	0%	18%	**6%**
Blog	0%	17%	0%	0%	**3%**
Kids Games	0%	17%	0%	0%	**3%**
Reordering Function	0%	0%	0%	9%	**3%**

Table 8: Summary of the app analysis
Source: Compiled by authors

7 Empirical study to optimize grocery apps

After having explored barriers and motivators of app use as well as preferred app functions from a theoretical point of view and after having analyzed existing app functions, the previous results are to be compared to current empirical findings. Grocery retailers should learn how to rate existing grocery apps and how to derive app optimization concepts from the results. Subsequently, there is a dire need for an adequate rating tool. However, before the selected grocery apps can be rated, suitable rating criteria have to be developed that characterize a perfect grocery app from a customer perspective. To not only rely on preferred app functions that have been revealed by previous studies and literature, an empirical study will extract app functions that can bring value added to customers. So, in this part of the paper a scientific model is chosen and applied in order to find out relevant customer requirements with respect to grocery apps, that can be rated according to their value added. This model will be the basis of an objective app evaluation.

Results of the following study will bring value added to the grocery as well as to the retail segment by extracting best practices of existing apps and giving hints for future developments. When retailers know on which app features to concentrate, they can develop tailor-made solutions that fit their mobile strategy and enhance customer adoption.

This study contributes to research by examining customers' preferences with regard to grocery apps and by giving guidelines how to add customer value to existing as well as upcoming grocery apps. In the end, the selected apps from chapter six will be rated according to the study results.

7.1 Choice of the scientific model

During the extensive literature review models and methods came across that had been used in the context of app testing and development. So, the first approaches were the innovation diffusion model and the digital innovation model.

The innovation diffusion model does not fit the purpose of the analysis as it illustrates the adoption of new digital technologies (Hanlon, 2013). Albeit apps can be seen as digital technologies, they are neither completely new products nor does the innovation diffusion model reveal their customer value, but looks at the app as a whole and its adoption rate in relation to time.

As a second option, the digital innovation model was contemplated. This model seemed suitable on the face of it as it serves as a tool to analyze new ideas for apps and software products. Despite of this fact, detailed research revealed that the digital innovation model is completely focused on structuring and planning software projects (Marktding, 2016). It can be seen as a story board to guide through a software development process and is therefore not suitable as the research focus of this paper demands to tackle the problem from a retailer's and customer's point of view. Trying to bring models in line with the main goals of this paper, the chosen model must provide the opportunity to explore customer satisfaction and customer requirements. Assessing customer preference and satisfaction, the conjoint analysis, the value proposition model and the Kano model were further taken into consideration. The conjoint analysis brings in line price and product characteristics by letting customers decide between several product alternatives and price ranges (Fleig, 2016). As grocery apps developed by food retailers do not require a fee, the analysis would lack an essential component. Moreover, it would be hardly possible to find detailed alternative products that could be weighed against each other by an adequate target group.

The value proposition model serves to bring in line customer needs and the value proposition of a product. It matches customers' tasks, gains and pains with an adequate product with features that create gain and relieve pain (Tagwerker-Sturm, 2016). Therefore, a detailed and accurate profile of grocery app users would have to be created to derive specific tasks, gains and pains. However, authors are in large disagreement with target groups for grocery apps. To correctly apply the value proposition model, lengthy studies would have to precede that identify a limited target group with clear tasks and problems.

In the end, to contrast customer requirements from literature with results of an empirical study on app functions, the Kano model suits best. The model developed by Professor Noriaki Kano claims that customers' perception of quality is often unstructured and incomplete, but a structured data collection helps filter out pivotal customer preferences to integrate in a certain product or service. However, it should be pointed out that the classification of requirements done by the Kano model is "qualitative in nature" (Hussain, Mkpojiogu & Kamal 2015, p. 158) and not quantitative (Hussain, Mkpojiogu & Kamal 2015, p. 158). The main goal of the Kano model is to

find out the relation between product features and customer satisfaction. Kano offers a scientific framework based on a questionnaire to rate customers' evaluations on product features as positive, negative or neutral (Mkpojiogu & Hashim, 2016, par. 4). Moreover, the model attributes requirements as parts of different categories with a varying impact on user satisfaction depending on fulfilment or non-fulfilment. Thanks to the Kano model important data can be elicited that help understand which product characteristics have a greater impingement on satisfaction and which are considered must-be criteria in the eyes of the customer (Sauerwein, Bailom, Matzler & Hinterhuber, 1996, p. 313). In his model, Kano (See Kano, Seraku, Takahashi & Tsuji, 1984, pp. 39-48) differentiates between three types of customer requirements that provoke different degrees of satisfaction illustrated by figure 13. The three types of requirements are presented in the following.

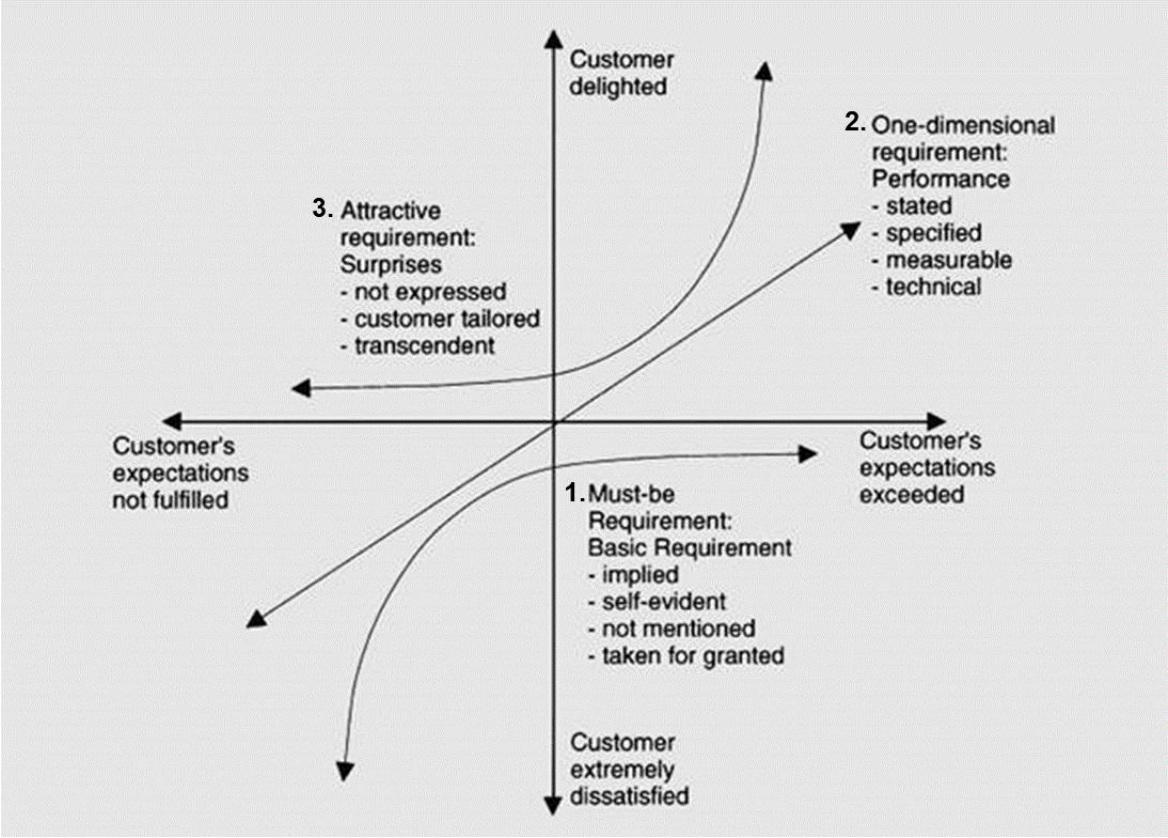

Figure 13: Kano's model of customer satisfaction
Source: Acc. to Berger et al. (1993), p. 26

1. Must-be requirements

   If these requirements are not met by the product, customers will be utterly unsatisfied. However, a fulfilment of the requirement does not automatically bring about customer satisfaction as customers take must-be requirements for granted. Must-be criteria are deemed prerequisites and therefore only provoke an emotional state of non-dissatisfaction when met. Must-be requirements turn out to be highly competitive factors as non-fulfilment will lead to customer disinterest (Sauerwein et al., 1996, pp. 313-314).

2. One-dimensional requirements

   With respect to these requirements “customer satisfaction is proportional to the level of fulfilment” (Sauerwein et al., 1996, p. 314). In short, the better the fulfilment, the higher the customer satisfaction and vice versa. Customer demand for one-dimensional requirements is explicit.

3. Attractive requirements

   Customer satisfaction with a given product is closely linked to attractive requirements. If a product meets these requirements, customer satisfaction is disproportionately high due to the fact that the user did not expect this product feature and therefore did not explicitly call for it. A non-fulfilment does not provoke dissatisfaction, while fulfilment provokes overriding satisfaction (Sauerwein et al., 1996, p. 314).

A Kano questionnaire helps get direct and structured feedback on possible and existing features based on the three presented requirements. This questionnaire makes use of a specific questioning technique. Results are generated by using two types of questions per customer requirement, one functional (positive) and one dysfunctional (negative). Figure 14 differentiates the two types of questions.

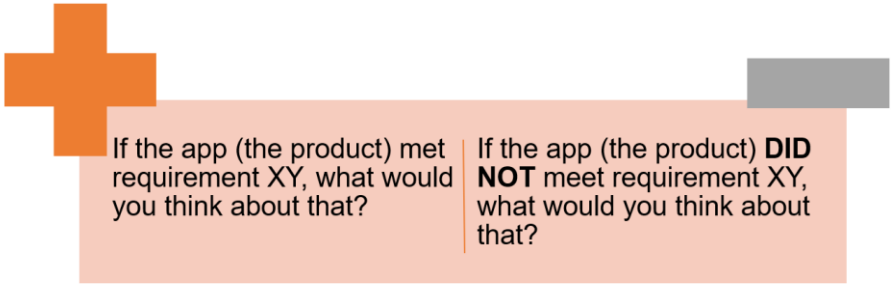

Figure 14: Functional and dysfunctional questioning technique
Source: Acc. to. Fraunhofer Gesellschaft (2007)

Both questions are to be asked directly after another. Five answers to choose from are predefined: (1) I would really like that, (2) I take that for granted, (3) I am neutral, (4) I could accept that and (5) I would not like it (Fraunhofer Gesellschaft, 2007, par. 3). By evaluating the combination of the two answers of the Kano questionnaire, it is possible to attribute an app function to one of the stipulated requirements (Marx, 2014, p. 12). The categories are determined using the Kano evaluation table.

7.2 Process of the Kano project

In the following study a Kano questioning was carried out in order to attribute different app functions as must-be, attractive or one-dimensional requirements. With these results a Kano model based on grocery app features was produced that serves as a tool to rate existing grocery apps. The main objective is to make suggestions for an optimized app with the potential to shape grocery retailing.

To query the most important criteria without an unnecessarily elongated questionnaire a preliminary survey had to be conducted. It was carried out in the mother tongue of the participants, which is German. Therefore, results have been translated. The questions in the preliminary questionnaire have been derived from literature as well as from the practical analysis of grocery apps done by the authors. Mostly, app features that have been identified as customers' preferred func-tions by previous studies have been used to formulate adequate questions. Motiva-tors and barriers identified in this paper have also been integrated to define reasons for and against app use. Moreover, the importance of app functions evaluated by different authors and studies was to be verified or rejected. The participants also rated the future-orientation of innovative app functions and added their own sugges-tions. The survey was carried out in form of an online questionnaire that was sent to International Retail Management students at ESB Business school that have started their studies in April 2016. This resulted in a sample of eleven retail students that have an expert status due to their professional background. All of them hold management positions at one of the leading grocery retailers in Germany. The results impinged on the app features that were used to create the Kano questionnaire. After a process time of six days, ten out of eleven students had answered the pre-liminary questionnaire. All of them use apps on a daily basis.

In the online survey, the present standard app functions were categorized into ‘Convenience’, ‘Economics’ and ‘Personalization’. They emanated from the results of previous studies presented in chapter five. In order to select suitable questions for the final Kano questionnaire the functions were put into a ranking according to importance measured by the arithmetic average. One ranking per category had to be filled by the participants. If two functions had the same arithmetic average, the function which had more votes for ‘very important’ and ‘important’ in sum was given priority. When there were only three functions per category, the one with the highest arithmetic average was eliminated.

Table 9 illustrates the selection process for Kano questions using the category ‘Personalization’ as a text book case. More detailed results can be viewed in the appendix.

	very important		important		neutral		unimportant		very unimportant		n.a.		
	1		2		3		4		5		0		
	Σ	%	Σ	%	Σ	%	Σ	%	Σ	%	Σ	Ø	Ranking
Shopping History	3x	30,00	3x	30,00	3x	30,00	1x	10,00	-	-	-	2,20	2
Loyalty Program	2x	20,00	5x	50,00	1x	10,00	2x	20,00	-	-	-	2,30	3
Personalized Offers	4x	40,00	2x	20,00	3x	30,00	1x	10,00	-	-	-	2,10	1
Dietary Recommendations	3x	30,00	2x	20,00	2x	20,00	3x	30,00	-	-	-	2,50	(4)
Social Media	-	-	2x	20,00	3x	30,00	2x	20,00	3x	30,00	-	3,60	(5)

Table 9: Importance ranking: Standard app functions for the final Kano questionnaire, Topic: Personalization
Source: Survey results (15/11/2017), compiled by authors, translated from German

As a next step, the participants had to rate innovative app functions according to their estimated customer value (See table 10). The functions had been filtered out of the author’s app analysis. The three functions with the best rating were selected to be queried in the Kano questionnaire.

	++		+		0		-		--		n.a.		
	1		2		3		4		5		0		
	Σ	%	Σ	%	Σ	%	Σ	%	Σ	%	Σ	Ø	Ranking
Use of Beacons	-	-	2x	20,00	1x	10,00	2x	20,00	-	-	5x	3,00	(5)
Mobile Payment	5x	50,00	4x	40,00	-	-	1x	10,00	-	-	-	1,70	2
Product Ratings	5x	50,00	4x	40,00	1x	10,00	-	-	-	-	-	1,60	1
Reordering Function	4x	40,00	4x	40,00	2x	20,00	-	-	-	-	-	1,80	3
Gift Card Balance	1x	10,00	1x	10,00	7x	70,00	1x	10,00	-	-	-	2,80	(4)

Table 10: Ranking innovative app functions according to customer value
Source: Survey results (15/11/2017), compiled by authors, translated from German

In the end, the participants were asked if they considered six app functions future-oriented (See figure 15). All of them have been tested by grocery retailers, but have not been officially launched yet. The three functions with the highest number of votes were used to create another part of the Kano questionnaire. Albeit in-store navigation and proposing substitute products reached the same number of votes, in-store navigation was given priority as an adequate Kano question could be formulated more explicitly. The students could also make proposals of additional app functions that should be further explored. Those were partly added to the Kano questionnaire.

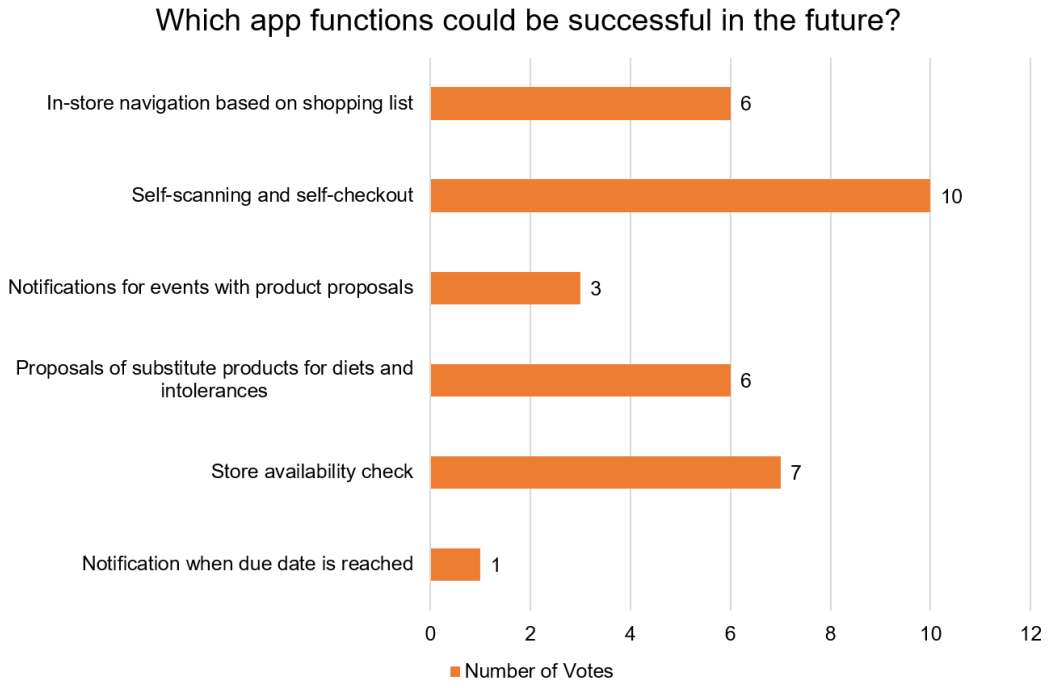

Figure 15: Rating of potential future app functions
Source: Survey results, (15/11/2017), compiled by authors, translated from German

The final Kano questionnaire was answered by experts of the retail segment. On the one hand, it was handed to professionals in the food retailing branch. On the other hand, students have been questioned that study Economics with a grocery retailing background. The sample of International Retail Management students was again queried. The experts gave their assessment in regard to existing and future app functions. Their expertise can pave the way for a future orientation of grocery apps and further studies. The Kano questionnaire was prepared in German language in order to not build up unnecessary barriers to participants, who were all German nationals.

Before being disseminated the questionnaire was pre-tested. The first six participants were supervised in order to check if the introduction and the survey instructions were comprehensible or had to be changed. This procedure was used to eliminate ambiguous or difficult terminologies. The instructions on the cover sheet turned out to be comprehensible and expedient.

The questionnaire included four introductory questions. Then, the Kano method was used to let participants give their opinion on 17 app functions: Nine standard functions, four innovative functions and four future functions. In the end, participants could bring in additional ideas.

7.3 Results of the Kano project

The results of the Kano project carried out in this paper deliver fundamentals for comparisons with past study outcomes and further research.

7.3.1 Sample and level of response

In sum, the Kano questionnaire was sent to 50 experts. After a period of two weeks, the response rate was 56 percent. So, 28 completed questionnaires could be evaluated. Of those, 54 percent were answered by professionals and 46 percent by students. The questionnaire was answered by 18 females and 10 males.

7.3.2 Introductory questions

At the beginning, the participants of the Kano questionnaire had to indicate if they were students or professionals. They were to tick their gender and age category. As an introductory question they were asked which barriers to app use they deemed

most influential. More than one answer could be given. As a result, a lack of technology acceptance was rated highest. At the second place, the respondents saw a lack of infrastructure, like WiFi in stores, a lack of customer value and the fear to lose personal data. Participants who gave free text responses pointed at a lack of app promotion and the limited memory function of smartphones, that hinder the use of grocery apps.

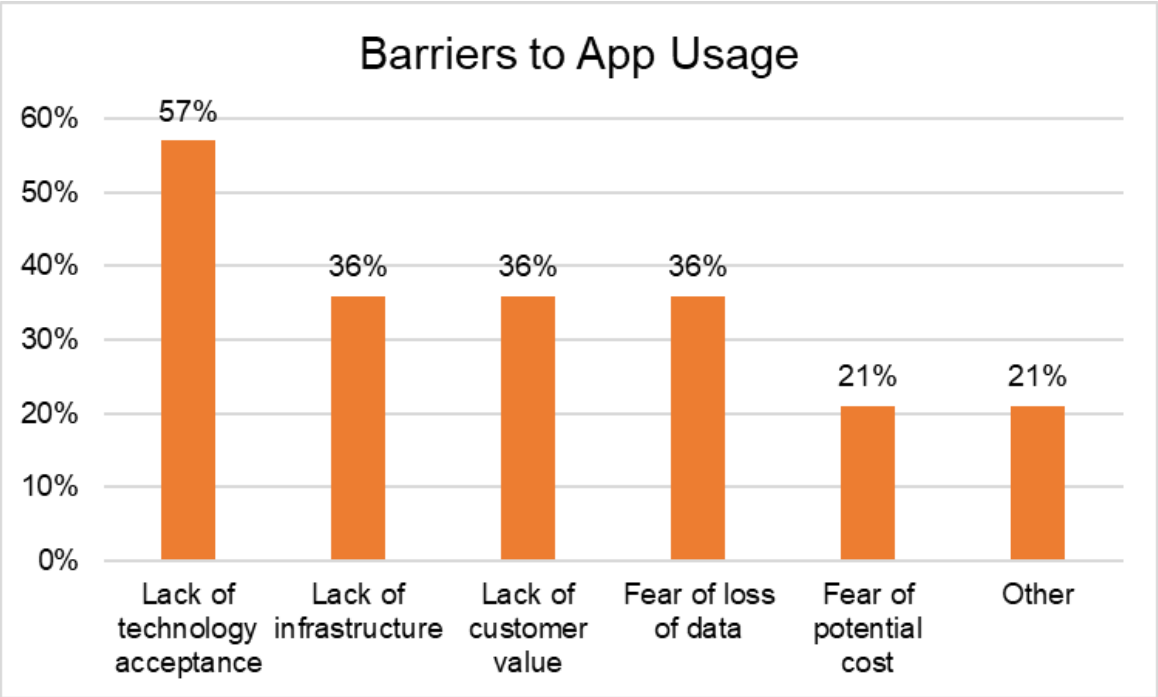

Figure 16: Barriers to app usage
Source: Study results, compiled by authors

7.3.3 Kano questions

In the second part of the questionnaire, 17 app functions were queried using the Kano questioning technique. Within the questionnaire they have been categorized into standard functions, innovative functions and future approaches.

Each combination of answers for each app feature was documented and analyzed. Then, each combination resulted in a Kano category according to the Kano table using the answers for the matching functional and the dysfunctional question.

Product Requirements		Dysfunctional Question				
		I would really like that	I take that for granted	I am neutral	I could accept that	I would not like it
Functional Question	I would really like that	Q	A	A	A	O
	I take that for granted	R	I	I	I	M
	I am neutral	R	I	I	I	M
	I could accept that	R	I	I	I	M
	I would not like it	R	R	R	R	Q

Table 11: Kano evaluation table
Source: Acc. to: Berger et al., 1993, p. 6; Sauerwein, 2000, p. 41

In the end, the function was put into the category that was given the highest number of votes. So, if most answer combinations referred to A, the given app function would be seen as part of the A category.

Using the Kano table, the queried app functions were categorized into the three Kano criteria that have been presented in this chapter before: Attractives (A), one-dimensionals (O) and must-bes (M). Additionally, I stands for indifferent, which means the feature is seen as unimportant by the sample, R stands for reverse, saying that the customer would prefer an opposite function, and Q for questionable. If Q is the result of a Kano question, this indicates a misunderstanding of the question or a wrong answer.

Kano Category		Indication	Influence on Satisfaction
M	Must-be	Feature is taken for granted by the customer	Fulfilment of the feature avoids dissatisfaction
O	One-dimension	Feature is explicitely demanded by the customer	Satisfaction proportional to degree of accomplishment
A	Attractive	Feature is not expected by the customer	Fulfilment leads to disproportionate rise of satisfaction
I	Indifferent	Feature is not seen important by the customer	Does not impinge on satisfaction
R	Reverse	The opposite is expected by the customer	Fulfilment leads to dissatisfaction
Q	Questionable	Question was misinterpreted, answered incorrectly or put in the wrong way	

Table 12: Understanding Kano categories
Source: Compiled by authors acc. to Marx (2014, p. 14)

An evaluation in absolute numbers according to table 11 gives a first overview over the final Kano results of this paper.

Product Requirement	A	O	M	I	R	Q	Category
Overview of the Product Range	3	4	16	5	-	-	M
Shopping List	9	9	4	6	-	-	A/O
Nutritional Facts	12	5	6	5	-	-	A
Information about Origin and Production	7	10	6	4	1	-	O
Personalized Offers	10	3	1	11	3	-	I
Shopping History	4	4	6	12	2	-	I
Loyalty Programs	13	4	4	7	-	-	A
List of special Offers	5	5	14	3	-	1	M
Mobile Coupons	12	8	1	7	-	-	A
Product Ratings	8	3	4	13	-	-	I
Mobile Payment	10	3	7	8	-	-	A
Reordering Function	10	6	6	6	-	-	A
Virtual Reality Content	7	-	1	20	-	-	I
Self-Scanning Option	20	2	-	6	-	-	A
Availability Check of Products in Store	11	9	4	3	1	-	A
In-Store Navigation	16	2	1	8	1	-	A
Compatibility to Wearables	10	1	3	14	-	-	I

Table 13: Absolute results of the Kano questionnaire
Source: Study results, compiled by authors

Due to the fact that there was only one questionable result, the authors conclude a well understanding of the questionnaire among participants.

In the end, the Kano results categorized the app functions in two must-bes, one one-dimensional, eight attractives and five indifferents. The shopping list function can be seen as a mixed criterion.

R shows a negative attitude towards a specific app function. For instance, three respondents opted against personalized offers. The fulfillment of this app function was seen negative and the non-fulfilment positive. Key reason could be giving-up personal data for personalization. One deemed the availability check of products disadvantageous. The fact could play a role, that customers who realize the non-availability of a certain product in advance, decide to make their groceries elsewhere. This comes with the disadvantage of losing combined purchases.

To get a better understanding of the distribution of the Kano criteria, table 14 illustrates the results in percentage.

Product Requirement	A	O	M	I	R	Q	Category
Overview of the Product Range	11%	14%	57%	18%	-	-	M
Shopping List	32%	32%	14%	21%	-	-	A/O
Nutritional Facts	43%	18%	21%	18%	-	-	A
Information about Origin and Production	25%	36%	21%	14%	4%	-	O
Personalized Offers	36%	11%	4%	39%	11%	-	I
Shopping History	14%	14%	21%	43%	7%	-	I
Loyalty Programs	46%	14%	14%	25%	-	-	A
List of special Offers	18%	18%	50%	11%	-	4%	M
Mobile Coupons	43%	29%	4%	25%	-	-	A
Product Ratings	29%	11%	14%	46%	-	-	I
Mobile Payment	36%	11%	25%	29%	-	-	A
Reordering Function	36%	21%	21%	21%	-	-	A
Virtual Reality Content	25%	-	4%	71%	-	-	I
Self-Scanning Option	71%	7%	-	21%	-	-	A
Availability Check	39%	32%	14%	11%	4%	-	A
In-Store Navigation	57%	7%	4%	29%	4%	-	A
Compatibility to Wearables	36%	4%	11%	50%	-	-	I

Table 14: Percentage results of the Kano questionnaire
Source: Study results, compiled by authors

There exist more ways to further evaluate the Kano results. Some of them will be presented in the following. After the different app functions have been categorized the results are to be explained in detail.

An overview of the product range as well as a list of special offers are seen as must-be criteria. Grocery apps that miss one of these functions fail to meet basic customer requirements.

Additional information about origin and production is rated a one-dimensional. This means the better the fulfilment of this app feature, the bigger customer satisfaction. Apps that offer more detailed product information can generate more satisfied users, while retailers should not neglect that a suboptimal fulfilment provokes dissatisfaction.

There are three standard functions that provide grocery retailers with the opportunity to disproportionately delight users as attractives. Nutritional facts satisfy the customer when available, but do not provoke high dissatisfaction in case of non-avai-lability. The same is true for loyalty programs and mobile coupons. Two of four in-novative functions are also seen as attractives. Mobile payment and a reordering function can enhance customer satisfaction.

Three of four future grocery app functions were rated A criteria. This seems logical as functions customers are not familiar with are more likely to generate enthusiasm among users due to the fact that they were not expected. The more innovative app functions seem to customers, the more likely they provoke overriding customer sa-

tisfaction. The shopping list function was categorized as mixed (A/O). In case of an ambiguous category, Sauerwein (2000, p. 45) recommends the following decision rule: M>O>A>I. This seems logical to the authors as retailers should first of all focus on the app functions that provoke dissatisfaction when lacking, before adding at-tractives. Therefore, the shopping list function is further seen as one-dimensional. Functions that are categorized as indifferent to the customer give hints to companies in which fields not to invest. Investing in app features that are irrelevant to the cus-tomer, does not enhance satisfaction but bring about a waste of money and re-sources.

Figure 17 illustrates the Kano model for grocery apps as a result of this research study.

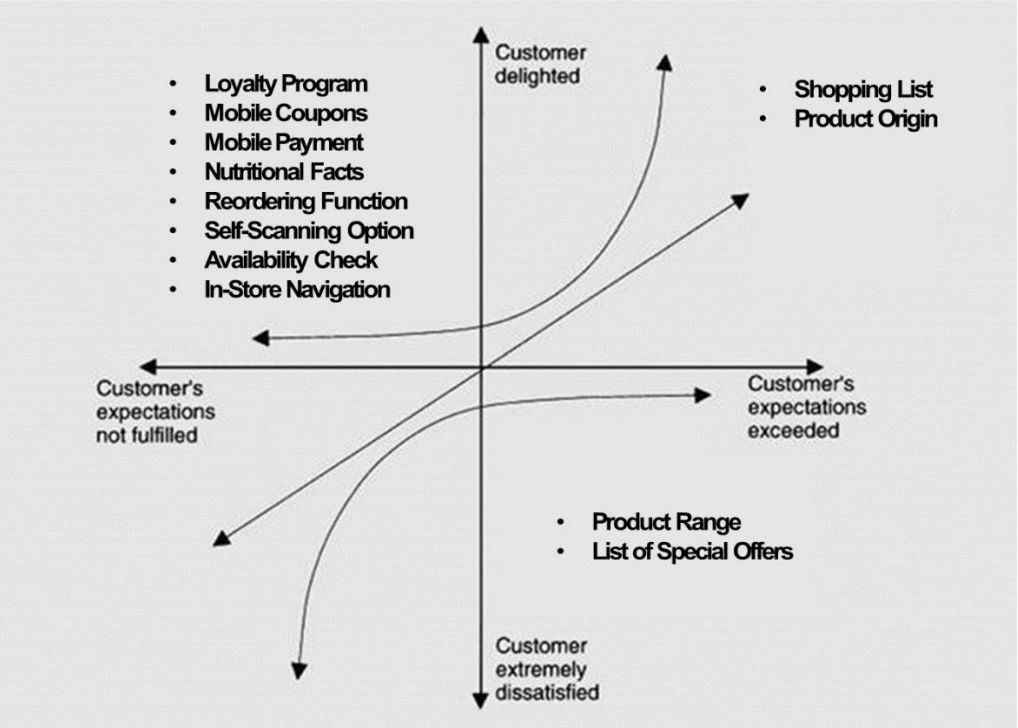

Figure 17: Kano model of grocery app functions
Source: Compiled by authors, inspired by Berger et al. (1993), p. 26

To highlight the role of the grocery app functions as indicators of customer satisfaction or dissatisfaction a more detailed evaluation of the Kano results, the satisfaction coefficient, is presented. The coefficient shows if the fulfilment of a product requirement leads to an increase of satisfaction or to avoidance of dissatisfaction (Berger et al., 1993, p. 18). It is of vital importance to measure the impact the app function

has on customer satisfaction (Sauerwein et al., 1996, p. 51). The calculation of the two different indices is illustrated in figure 18 and follows here Sauerwein representing satisfaction and dissatisfaction in a well-balanced way.

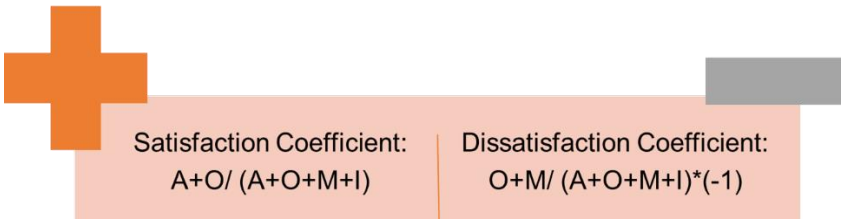

Figure 18: Calculation of the satisfaction coefficient
Source: Acc. to Sauerwein et al., 1996, p. 52

Product Requirement	Satisfaction Coefficient	Dissatisfaction Coefficient	Total Impact	Category
Overview of the Product Range	0.25	-0.71	0.96	M
Shopping List	0.64	-0.46	1.11	A/O
Nutritional Facts	0.61	-0.39	1.00	A
Information about Origin and Production	0.63	-0.59	1.22	O
Personalized Offers	0.52	-0.16	0.68	I
Shopping History	0.31	-0.38	0.69	I
Loyalty Programs	0.61	-0.29	0.90	A
List of special Offers	0.37	-0.70	1.07	M
Mobile Coupons	0.71	-0.32	1.03	A
Product Ratings	0.39	-0.25	0.64	I
Mobile Payment	0.46	-0.36	0.82	A
Reordering Function	0.57	-0.43	1.00	A
Virtual Reality Content	0.25	-0.04	0.29	I
Self-Scanning Option	0.79	-0.07	0.86	A
Availability Check	0.74	-0.48	1.22	A
In-Store Navigation	0.67	-0.11	0.78	A
Compatibility to Wearables	0.39	-0.14	0.55	I

Table 15: Satisfaction and dissatisfaction coefficient
Source: Study evaluation, compiled by authors

Thanks to the satisfaction and the dissatisfaction coefficient the total impact of an app function is calculated (Satisfaction coefficient + Dissatisfaction coefficient *(-1)). It comes clear that app functions, that have been rated indifferents, have a low total impact. The higher the total impact the more important is the app function for customer satisfaction or dissatisfaction. The must criteria have a higher dissatisfaction index than a satisfaction index as their existence is taken for granted by customers, while their non-existence causes dissatisfaction. The coefficients of one-dimensionals are similar as satisfaction, respectively dissatisfaction, varies proportionally

with fulfilment and non-fulfilment. Attractive app criteria usually have very high satisfaction coefficients and very low dissatisfaction coefficients as users do not expect these functions and therefore are not dissatisfied when the feature is lacking, but utterly satisfied, when it exists. Suitable textbook cases would be in-store navigation and the self-scanning options. Attractive features like the reordering function or mobile payment have lower impacts as their categorization was not as unambiguous. The spreading of the satisfaction/dissatisfaction coefficient is illustrated in figure 19.

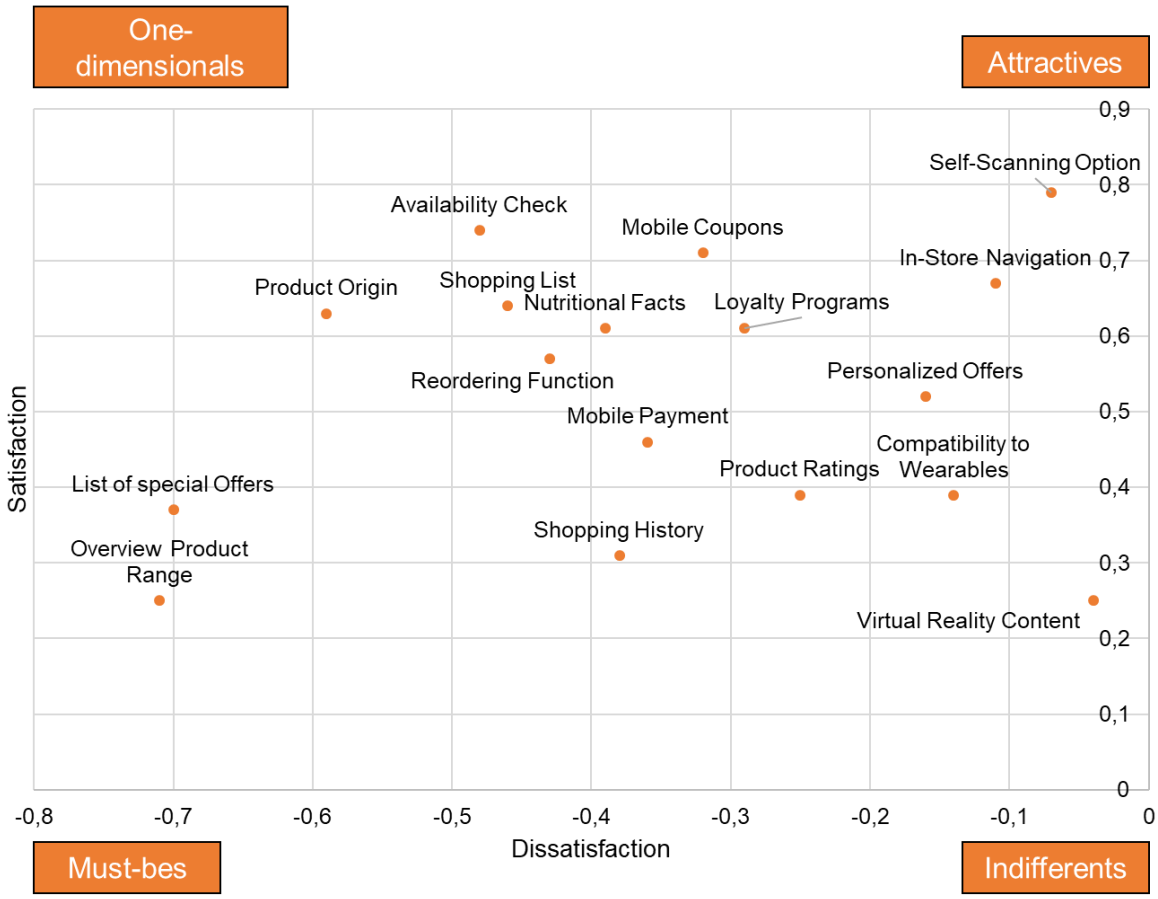

Figure 19: App features in satisfaction/dissatisfaction diagram
Source: Study evaluation, compiled by authors

Looking at the diagram above, one of the shortcomings of the Kano model comes clear. For instance, according to the model, the fulfilment of must-be criteria does only avoid dissatisfaction. However, the list of special offers and the product range overview account for 0.37, respectively 0.25 of satisfaction according to the satisfaction coefficient. Moreover, indifferents do neither provoke nil dissatisfaction nor nil satisfaction.

Another interesting evaluation was carried out to explore if professionals have different opinions about grocery app functions than students.

Product Requirement	A	O	M	I	R	Q	Category
Overview of the Product Range	-	13%	60%	27%	-	-	M
Shopping List	27%	33%	20%	20%	-	-	**O**
Nutritional Facts	53%	20%	20%	7%	-	-	A
Information about Origin and Production	27%	47%	20%	7%	-	-	O
Personalized Offers	47%	13%	7%	20%	13%	-	**A**
Shopping History	20%	13%	27%	33%	7%	-	I
Loyalty Programs	47%	20%	20%	13%	-	-	A
List of special Offers	13%	20%	60%	7%	-	-	M
Mobile Coupons	47%	33%	-	20%	-	-	A
Product Ratings	20%	13%	20%	47%	-	-	I
Mobile Payment	33%	13%	27%	27%	-	-	A
Reordering Function	13%	27%	33%	27%	-	-	**M**
Virtual Reality Content	13%	-	-	87%	-	-	**I**
Self-Scanning Option	73%	7%	-	20%	-	-	A
Availability Check	33%	33%	13%	13%	7%	-	**A/O**
In-Store Navigation	53%	7%	7%	27%	7%	-	A
Compatibility to Wearables	33%	7%	13%	47%	-	-	I

Table 16: Kano results according to professionals
Source: Study evaluation, compiled by authors

Product Requirement	A	O	M	I	R	Q	Category
Overview of the Product Range	23%	15%	54%	8%	-	-	M
Shopping List	38%	31%	8%	23%	-	-	**A**
Nutritional Facts	31%	15%	23%	31%	-	-	**A/I**
Information about Origin and Production	23%	23%	23%	23%	8%	-	**A/O/M/I**
Personalized Offers	23%	8%	-	62%	8%	-	I
Shopping History	8%	15%	15%	54%	8%	-	I
Loyalty Programs	46%	8%	8%	38%	-	-	A
List of special Offers	23%	15%	38%	15%	-	8%	M
Mobile Coupons	38%	23%	8%	31%	-	-	A
Product Ratings	38%	8%	8%	46%	-	-	I
Mobile Payment	38%	8%	23%	31%	-	-	A
Reordering Function	62%	15%	8%	15%	-	-	A
Virtual Reality Content	38%	-	8%	54%	-	-	I
Self-Scanning Option	69%	8%	-	23%	-	-	A
Availability Check	46%	31%	15%	8%	-	-	A
In-Store Navigation	62%	8%	-	31%	-	-	A
Compatibility to Wearables	38%	0%	8%	54%	-	-	I

Table 17: Kano results according to students
Source: Study evaluation, compiled by authors

This evaluation makes differences between professionals' and students' opinions visible. While professionals from the grocery sector see the shopping list function as a one-dimensional, it is an attractive criterion for student experts. Moreover, students consider nutritional facts revealed by an app less important than professionals. They have a very unclear perception of additional product information.

7.4 Rating of the selected apps according to the Kano results

Table 18 combines the table in chapter six and the Kano categorization. The app features marked in orange had been identified as preferred app functions by literature. So, now the following comparison shows if past studies correspond with the results of the Kano project. Moreover, the column 'sum' shows how many of the analyzed apps have adopted the explored functions.

Queried Function/Country	Germany	Austria	UK	US	Sum	Kano
No. of Apps tested	**10**	**6**	**7**	**11**	**100%**	**Category**
Loyalty Program	30%	50%	29%	64%	**59%**	**A**
Mobile Coupons	30%	50%	0%	55%	**21%**	**A**
Mobile Payment	20%	17%	0%	9%	**24%**	**A**
Nutritional Facts	10%	50%	86%	55%	**47%**	**A**
Reordering Function	0%	0%	0%	9%	**3%**	**A**
Personalized Offers	10%	0%	14%	9%	**9%**	**I**
Product Ratings	10%	0%	57%	55%	**32%**	**I**
Purchase History	0%	50%	71%	9%	**26%**	**I**
Overview Product Range	10%	50%	71%	73%	**50%**	**M**
Special Offer List	100%	67%	86%	100%	**91%**	**M**
Information about Product Origin	80%	17%	86%	18%	**12%**	**O**
Shopping List	90%	67%	57%	100%	**82%**	**O**

Table 18: Comparison app analysis and Kano categorization
Source: Study evaluation, compiled by authors

As described before, app functions that have been rated preferred app functions by recent studies have been filtered by the study group of International Retail Management students. The feature 'information about product origin' has been added while discussing and reengineering the Kano questionnaire. Mobile payment, product ratings and a reordering function have been identified as vital innovative app functions that do exist, but that are still seldom.

First, the must-bes are examined. A list of special offers as well as an overview over the product range have also been highlighted by other studies. While a list of special offers comes with 91 percent of the apps, only half of them provide a product range overview. So, there is a definite need of improvement here as lacking must criteria provoke dissatisfaction among consumers.

Moreover, grocers should be aware that lacking O-criteria also cause dissatisfaction among users. While the shopping list function is available with 79 percent of the selected apps, only twelve percent deliver additional product information.

Standard app functions that have been highlighted in past studies have also mostly been categorized as attractives in the Kano project. Apps with A-rated functions can

highly attract customers. However, it is of vital importance to first fulfil criteria that can cause dissatisfaction when non-existent. Loyalty programs and nutritional facts are the mostly adopted attractive app criteria.

Personalized offers, product ratings and a purchase history, that were preferred app functions according to Childs (2013, 2015), have been categorized indifferents. Here, grocers should not further invest in the development of those app functions as they do not impinge on customer satisfaction.

When it comes to future app functions, grocers can generate competitive advantages developing app functions that are rated A-criteria. I-criteria should not be treated as priorities.

Queried Function	Category
Virtual Reality Content	I
Self-Scanning Option	A
Availability Check of Products in Store	A
In-Store Navigation	A
Compatibility to Wearables	I

Table 19: Categorization of future app functions
Source: Study evaluation, compiled by authors

In sum, it can be stated that the fulfilment of must-criteria is prerequisite to make customers accept grocery apps. One-dimensionals also have to be present in order to proportionally enhance customer satisfaction. If those features are fulfilled, grocery apps can benefit from competitive advantages in form of attractive criteria to stand out. To rank the selected apps according to quantitative criteria, the following scale has been used to award points according to the Kano category.

	Fulfilment	Non-fulfilment
M	0	-10
O	5	-5
A	10	0

Table 20: Ranking scale of analyzed apps
Source: Compiled by authors

If a must-be criterion is fulfilled, according to the Kano model, this does not enhance customer satisfaction, but prevents dissatisfaction. Therefore, 0 points are given for

fulfilment and -10 for non-fulfilment. One-dimensionals account for proportial satisfaction or dissatisfaction. That is why 5 or -5 points can be achieved. Attractives account for overriding satisfaction when existent, but do not impinge on dissatisfaction. They epitomize the counterpart of must-bes in the scoring model. Indifferents are neglected due to their minor importance.

Table 21 provides an attempt of combining the Kano model with a scoring model to make the analysis quantitative.

		Special Offer List	Product Range	Shopping List	Product Origin	Loyalty Program	Mobile Coupons	Mobile Payment	Nutritional Facts	Reordering	Score
	Kano Criterion	M	M	O	O	A	A	A	A	A	
Germany	Edeka	0	-10	5	5	0	10	10	0	0	20
	Netto	0	-10	5	5	10	10	10	0	0	30
	Lidl	0	-10	5	5	0	0	0	0	0	0
	Kaufland	0	-10	5	-5	0	0	0	0	0	-10
	Rewe	0	-10	5	5	10	0	0	10	0	20
	Penny	0	-10	5	5	0	10	0	0	0	10
	ALDI SÜD	0	-10	5	5	0	0	0	0	0	0
	ALDI Nord	0	-10	5	5	0	0	0	0	0	0
	Real	0	-10	-5	5	10	0	0	0	0	0
	Norma	0	0	5	-5	0	0	0	0	0	0
Austria	Hofer	0	0	5	-5	0	0	0	0	0	0
	Billa	-10	-10	5	-5	10	10	10	10	0	20
	Merkur	0	-10	-5	5	10	10	0	10	0	20
	Interspar	-10	0	-5	-5	10	10	0	0	0	0
	Mpreis	0	-10	5	-5	0	0	0	0	0	-10
	Unimarkt	0	0	5	-5	0	0	0	10	0	10
UK	Tesco	0	0	5	5	10	0	0	10	0	30
	Sainsbury	0	0	-5	5	0	0	0	10	0	10
	ASDA	0	0	5	5	0	0	0	10	0	20
	Morrisons	0	0	5	5	0	0	0	10	0	20
	ALDI UK	0	-10	-5	-5	0	0	0	10	0	-10
	Marks&Spenc	-10	0	-5	5	10	0	0	10	0	10
	Lidl UK	0	-10	5	5	0	0	0	0	0	0
US	Walmart	0	0	5	-5	10	0	10	10	10	40
	Costco	0	0	5	5	10	10	0	10	0	40
	Kroger	0	0	5	-5	10	10	0	0	0	20
	Target	0	-10	5	5	10	0	0	0	0	10
	Safeway	0	0	5	-5	10	0	0	0	0	10
	Publix	0	0	5	-5	0	10	0	0	0	10
	Kmart	0	0	5	-5	10	10	0	10	0	30
	HEB	0	0	5	-5	0	10	0	10	0	20
	Meijer	0	-10	5	-5	10	10	0	10	0	20
	Whole Foods	0	-10	5	-5	0	0	0	10	0	0
	ALDI US	0	-10	5	-5	0	0	0	0	0	-10

Table 21: App rating according to Kano results
Source: Study evaluation, compiled by authors

Looking at the table above, it must be stated that the selected apps have only been rated according to the limited number of Kano criteria that have been explored in

the course of this paper. The choice of different criteria as well as the examination of all app functions analyzed in chapter six will bring about different, respectively more detailed results.

It comes clear that Walmart and Costco have reached the highest score.

The Edeka, Netto and REWE app can be seen as best practice examples in Germany. Apps with a score of -10 do lack must-be criteria as well as one-dimensionals at the same time.

However, it must be pointed at the fact that apps lacking must-be criteria do not fulfil basic customer requirements. This is a key disadvantage trying to attract and bind customers to a mobile application.

8 Key findings of the study

In the last chapter key findings of this study will be presented with a focus on best practices in the segment of grocery app functions derived from the ratings in chapter seven. Afterwards, key competencies that help grocers differentiate from competitors in the field of app development are illustrated. Limitations of the study are to be discussed. In the end, summary and conclusion of the study are given.

8.1 Best practices

As loyalty towards a specific grocer has never been lower before, food retailers have to seek ways to attract customers and to build up a mutual relationship. A grocery app can improve a tailored customer approach, enhance customer loyalty and finally make grocers differentiate from stiff competition. These are clear added values apps can bring to companies. In short, apps come with a host of advantages - if they are used.

But in order to be accepted among users, they have to deliver a true customer value. So, taking over a customers' point of view is indispensable here.

Reasons for customers' scepticism towards grocery apps have additionally been identified. Technology acceptance is still one of the main barriers as well as a lack of infrastructure and the fear of loss of data. In order to cushion customers' reluctance towards grocery apps, the benefits of grocery app use have to outweigh their cost. Past studies have shown that there are barriers of app use that should be overcome by highlighting motivators.

Moreover, customers have their preferred app functions, on which focus should be put, when developing or improving a grocery app. App features that impinge on customer satisfaction can be put in different categories. Thanks to the Kano project this paper has verified the vital importance of a product range overview and a special offer list within grocery apps. Furthermore, it has proved the impact of a shopping list function and information on the product origin on a proportionally grow-ing customer satisfaction. The study has also shown that standard functions like an integrated loyalty program, mobile coupons and the dissemination of nutritional facts are deemed enormously attractive by customers. Innovations like mobile payment and a reordering function also give promising incentives to potential app users. How-ever, in the end it has also become clear that functions that have been rated very

important in recent studies, like a shopping history and product ratings are rather indifferent to grocery shoppers. Therefore, grocers that want to benefit from successful apps as a mobile marketing tool should make sure must-be app features are existent. Moreover, they should perfect one-dimensional app features to bring about the highest linear customer satisfaction possible, they should wisely combine attractives and they should never waste valuable resources for indifferents. After an app rating derived from the Kano criteria the Walmart app and the Costco app have turned out to be the best existing practices until now and should be seen as text book cases.

But in the end the best grocery app is not worthwhile when not being promoted!

8.2 Key competencies for companies making use of grocery apps

In order to be successful in the mobile market, companies will need crucial guidelines to launch and run grocery apps. Competencies in this sector are direly needed and can turn out to be critical factors to outperform stiff competition.

The following key competencies are extracted from the study results:

1)	Build up a mobile strategy for your company before launching an app!
2)	Mobile marketing generates value for the company!
3)	Smartphones can be used to be visible in customers' daily lives.
4)	See apps as part of the digital revolution!
5)	Do not only rely on the company's mobile website!
6)	Use app motivators to overcome scepticism!
7)	Get to know customers' app preferences!
8)	Learn from competitors' success and failures!
9)	Standard functions can still make an app stand out!
10)	Make use of innovative functions to surprise customers!
11)	Perfect one-dimensional functions to reach the best possible customer satisfaction!
12)	Do not waste resources for indifferents!

Table 22: Key competencies for companies making use of grocery apps
Source: Compiled by authors

8.3 Limitations of the study and further research

There exist limitations of the study that must be mentioned. First of all, there are shortcomings that emanate from the Kano model itself. As a first aspect, customer satisfaction and customer demand cannot be evaluated on a quantitative basis. The

authors have tried to produce quantitative results by developing a scoring model de-rived from the Kano results. Second, the scale of the Kano questionnaire is stipu-lated by the model itself. On the one hand, the scale can be seen as incoherent by respondents who do not have heard of the Kano model before. They might think that the monotony of the questions is not part of a scientific model, but an unaptness of the researcher. On the other hand, due to the monotonous response options par-ticipants might lose interest in a careful completion of the questionnaire.

More limitations can emanate from the execution of the Kano project. First of all, the interrogative form of the Kano questionnaire needs comprehensible instructions. Pre-tests have indicated that the instructions given in form of a cover sheet of the written questionnaire were clear. However, the authors cannot guarantee that all answers have been given with a clear understanding of the task. Another shortcoming could lie in the selection of the app functions. Normally, the queried criteria are filtered out of customer interviews. However, due to the limited processing time of this paper and the lack of a suitable customer research group that are familiar to grocery app use, the functions have been extracted from literature and practical app analysis. However, due to the fact that the functions have been selected by experts instead of the authors themselves, the selected criteria are more representative.

Experts have answered the questionnaire instead of customers. This has been done by researchers before (See Marx, 2014), but as the sample is quite limited, the study might not be representative. The small sample also aggravates an unambiguous categorization of app functions into one of the Kano criteria. However, experts might express the needs of the branch more explicitly than end consumers.

Moreover, the scoring model can only rank apps according to the functions queried in the Kano questionnaire. Different functions might provoke different results. Furthermore, layout and design of the apps has not been taken into account.

Therefore, the authors recommend the same study with a larger sample. As only German nationals have been questioned, it could be carried out on an international basis to filter out differences of app requirements in various nations. Following studies should take into account layout and design of the analyzed apps.

8.4 Summary and conclusion

This paper has made an attempt to investigate if mobile applications are meant to stay a marginal topic in the segment of grocery shopping, or if they have the potential to significantly shape the future of grocery retailing by serving as competitive advantages that can fulfil customer requirements and satisfaction. It has filtered out success factors in form of functions of grocery apps and it has extracted key competencies that can be used to create customer value. Grocery apps must fulfil the objectives of mobile marketing in order to deliver value added to companies in form of a loyal customer base, information exchange, an image transfer and finally a rise of sales. All those pivotal advantages can only be generated if grocery apps are accepted among customers. This challenge can be met by taking over a customer point of view analyzing existing grocery apps. However, it does not suffice to simply copy existing app solutions. Customer value is created when companies generate the knowledge to design their apps according to customer requirements. However, companies must not neglect that those requirements can change with a rapid pace. If demanded app features are realized on a regular basis, the app becomes more appealing to customers. In the end, grocery apps must prove themselves being attractive and useful. This leads to acceptance among users and therefore a higher adoption rate. Grocers that realize a higher adoption rate of their apps and manage a customer base that uses grocery apps on a regular basis can differentiate from competitors and benefit from app use.

The Kano model can help selecting the right app functions. But, there are other prerequisites, like customers' general attitude towards technology and their acceptance towards any kind of apps, that play an important role looking at the big picture of apps in grocery retailing.

However, this paper has contributed one vital part of giving more importance to apps in grocery retailing in form of app functions that clearly deliver customer value.

In short, apps that fit customers' needs and that provide usability and convenience clearly have the potential to shape the future of grocery retailing - if key barriers towards app use are eliminated and if incentives are given that overcome scepticism.

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